Printed on Thin Paper for Foreign Circulation.

FEB 23 1924

The Engineer.

Established 1856.

Registered as a Newspaper.

OFFICE FOR ADVERTISEMENTS & PUBLICATION, 33, NORFOLK ST., STRAND, LONDON, W.C. 2.

VOL. CXXXVII.—No. 3554] LONDON: FRIDAY EVENING, FEBRUARY 8, 1924 [PRICE ONE SHILLING BY INLAND POST 1s. 3d.

The Engineer

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PUBLIC NOTICES

Ministry of Transport.

SURFACING OF ARTERIAL ROADS.

TENDERS for BITUMINOUS SURFACING in connection with certain sections of the Arterial Road known as Watling-street, Kent.

Specifications, bills of quantities, forms and conditions of Tender may be obtained from the Chief Engineer, Arterial Roads Department, Ministry of Transport, 7, Whitehall-gardens, S.W. 1, upon payment of a deposit of £25.

This amount will be returned to the tenderer if his Tender is a bona fide one, and has not been withdrawn prior to the definite acceptance of a Tender by the Minister.

The drawings and conditions of contract may be inspected at the Ministry, and copies of the specification, bill of quantities, &c., will be available on and after the 13th February, 1924.

Tenders, on the official forms, and accompanied by a fully priced bill of quantities, must be submitted in a sealed envelope, endorsed "Tender for Watling-street—Second Surfacing Contract."

The Minister does not bind himself to accept the lowest or any Tender.

Tenders must reach the undersigned by 10 a.m. on the 22nd day of February, 1924.

Dated this 6th day of February, 1924.

(Sd.) H. H. PIGGOTT,
Assistant Secretary.

Ministry of Transport. 4856

The Director-General,

India Store Department, Branch No. 15, Belvedere-road, Lambeth, S.E. 1, REQUIRES:—

RAILS and FISH-PLATES.

Tenders due on the 19th February, 1924.

Tender forms obtainable from above. 4877

SALE BY TENDER.

Tenders are Invited for

the PURCHASE, DISMANTLING and REMOVAL of PLANT (Boilers, Electric Motors, &c.), lying at the Head Post Office, Liverpool.

Tenders will be received until 10 a.m. on Friday, the 15th February, 1924.

Forms of Tender, containing full particulars, can be obtained on application to the Controller, Post Office Stores Department (Accounts Section), Studd-street Depot, Islington, London, N. 1.

The Postmaster-General does not bind himself to accept the highest or any Tender.

By Order of the
POSTMASTER-GENERAL.

General Post Office,
February, 1924. 4830

G. R.

SALE BY TENDER.

Tenders are Invited for the

PURCHASE of the following War Department PLANT at the Central Ordnance Depot, Chilwell, Notts.:—

(1) An AERIAL ROPEWAY on the Mono-cable system, approximately 1300ft. between stations, carried on 8 standards of varying heights, working at an average speed of 400ft. per minute, and having a carrying capacity of about 60 tons per hour. There are 11 Wooden Buckets fitted with Hanging Brackets and Rope Grips; also 1 Spare Terminal Wheel 7ft. diameter.

(2) A BRIDGE, constructed of Braced Steel Girders, with timbered floor; height 16ft., length 40ft., width 17ft., used for carrying the above Ropeway over a road.

Tenders should be addressed to:

The DIVISION OFFICER, R.E.,
Central Ordnance Depot,
Chilwell, Notts.

The War Department does not bind itself to accept the highest, or any, Tender. 4805

INDIAN SERVICE OF ENGINEERS.

The Secretary of State

for India in Council will, in 1924, APPOINT 15 ASSISTANT EXECUTIVE ENGINEERS for this Service, if so many suitable candidates present themselves.

Every candidate must be a British subject or a ruler or subject of any State in India in respect of whom the Governor-General of India in Council has made a declaration that he is to be considered eligible.

Candidates must be not less than 21 years of age and not more than 24 years on 1st August, 1924.

They must either (1) have obtained one of certain recognised University degrees or other distinctions in Engineering, or (2) have passed Sections A and B of the Associate Membership Examination of the Institution of Civil Engineers or been exempted by the Institution from such examination, or (3) produce the required evidence that they are otherwise eligible under the Regulations. They must in addition have had at least one full year's practical experience of Civil Engineering under a qualified Civil Engineer at the time when they appear before the Selection Committee.

Applications from candidates must reach the India Office not later than 1st April. Printed forms, together with information regarding the conditions of appointment, may now be obtained from the SECRETARY, Public Works Department, India Office, Whitehall, London, S.W. 1.

India Office, London,
14th December, 1923. 4459

Royal Show.

LEICESTER,
JULY 1st to 5th, 1924.

EXHIBITION OF IMPLEMENTS, &c.

THE REGULATIONS AND FORMS OF APPLICATION FOR SPACE ARE NOW READY.

Applications must be made by

THURSDAY, 20th MARCH, 1924.

Live Stock entries close on May 1st; Produce, Forestry, and Horticultural Exhibitions on MAY 20th; Poultry on MAY 31st; Dogs on JUNE 13th; Competitions for Plantations, Home Nurseries, Orchards, and Fruit Plantations on MAY 1st.

T. B. TURNER, Secretary.

ROYAL AGRICULTURAL SOCIETY OF ENGLAND,
16, Bedford-square, London, W.C. 1. 4829

PUBLIC NOTICES

In the High Court of Justice. No. 0043 of 1924.
Chancery Division.
Mr. Justice Eve.
In the Matter of The REDHEUGH IRON and STEEL COMPANY Limited
and
In the Matter of The COMPANIES (CONSOLIDATION) ACT, 1908.

Notice is Hereby Given that by

Order dated the 28th day of January 1924 the Court has directed a Meeting of the Unsecured Creditors (other than Preferential Creditors) of the above-named Company to be convened for the purpose of considering and if thought fit approving with or without modification a SCHEME OF ARRANGEMENT proposed to be made between the said Company and its Unsecured Creditors (other than Preferential Creditors) and that such Meeting will be held at the County Hotel in the City and County of Newcastle-on-Tyne on Friday the 22nd day of February 1924 at 11 o'clock in the forenoon at which place and time all the aforesaid Unsecured Creditors (other than Preferential Creditors) are requested to attend. A copy of the said Scheme of Arrangement can be seen at the registered office of the Company situate at The Teams Gateshead-on-Tyne in the County of Durham between the hours of 10 a.m. and 2 p.m. on any week-day prior to the day appointed for the said meeting.

The aforesaid Unsecured Creditors (other than Preferential Creditors) may attend such Meeting and vote thereat either in person or by proxy; but all forms appointing proxy must be deposited with the Company at its registered office situate as aforesaid not later than 12 o'clock Noon on Thursday the 21st day of February 1924.

Forms of proxy may be obtained from the Secretary of the Company.

The Court has appointed Marmaduke Reginald Proudlock the Managing Director of the South Wales and Lincolnshire Steel Products Co. Ltd Sole Agents for the Redbourn Hill Iron and Coal Co. Ltd. or failing him Harry B. Toy a Director of the British Chilled Roll and Engineering Co. Ltd. to act as Chairman of the said Meeting and has directed the Chairman to report the result thereof to the Court.

The said Scheme of Arrangement will be subject to the subsequent approval of the Court.

Dated this 7th day of February 1924.

CROSSMAN, BLOCK, MATTHEWS and CROSSMAN,
16, Theobalds-road, W.C. 1.
Agents for DEES and THOMPSON,
Newcastle-on-Tyne.
Solicitors for the above-named Company. 4886

Borough of Gravesend.

MAIN DRAINAGE DEPARTMENT.

TO REINFORCED CONCRETE CONTRACTORS.

The Gravesend Borough Council invites TENDERS from contractors who have specialised in that class of work for the CONSTRUCTION of REINFORCED CONCRETE TANKS (upon piled foundations executed under another contract) and Sundry Work, comprising its new Sewage Outfall Works at Denton Marshes, near Gravesend, in accordance with drawings and specification prepared by Mr. Frederick T. Grant, the Engineer.

The aggregate capacity of the tanks amounts to approximately 600,000 gallons.

Drawings may be inspected and specification, general conditions of contract, bill of quantities and form of Tender obtained upon application to the Engineer at his office, 4, Woodville-terrace, Gravesend, on and after Monday, 11th February, 1924.

Such application must be accompanied by a deposit of Three Guineas, which will be returned after the receipt of a bona fide Tender, sent in accordance with the instructions on the form attached to the contract documents.

Tenders, addressed as noted on the form, must be delivered at the Council's Offices, 4, Woodville-terrace, Gravesend, not later than Mid-day on Monday, 25th February, 1924.

The Council does not bind itself to accept the lowest or any Tender.

(Signed) H. H. BROWN,
Town Clerk.

6th February, 1924. 4861

PUBLIC NOTICES

City of Hull Waterworks.

DUNSWELL PUMPING STATION.
CONTRACT No. 5.

The Water and Gas Committee are prepared to receive TENDERS from British manufacturers for the CONSTRUCTION and ERECTION of TWO SETS of PUMPING PLANT, each set capable of delivering Five Million Gallons of Water per 24 hours. The plant to consist of Reciprocating Pumps driven by any prime mover—steam, gas, oil, electricity, &c.

Particulars may be obtained from the undersigned on payment of a deposit of Five Pounds, which will be refunded on receipt of a bona fide Tender.

Sealed Tenders, endorsed "Pumping Plant," must be delivered not later than 10 a.m. on Wednesday, the 20th February, 1924.

By Order,
C. B. NEWTON, M. Inst. C.E.,
Engineer.

Guildhall, Hull,
29th January, 1924. 4773

Mid Sussex Joint Water Board.

CAST IRON WATER MAINS.
CONTRACT No. 4.

TENDERS are INVITED for HAULING, EXCAVATING, LAYING and JOINTING about 7 Miles of 12in. diameter and about 4 Miles of 9in. diameter CAST IRON WATER MAINS, with Valves and other Works incidental thereto.

The drawings may be seen, and copies of the specification, bill of quantities and form of Tender obtained, from the undersigned, upon payment of a deposit of £3 3s., which will be returned upon receipt of a bona fide Tender and the return of any documents supplied.

Tenders, in sealed envelopes, endorsed "Tender for Main Laying," are to be addressed to the Clerk to the Mid Sussex Joint Water Board, Boltro-road, Haywards Heath, and delivered there not later than 10 a.m. on Friday, the 7th day of March, 1924.

The Board do not bind themselves to accept the lowest or any Tender.

FRANCIS MARTIN, M.I. Mech. E.,
Engineer.

Waterworks Offices,
Haywards Heath, Sussex.
6th February, 1924. 4859

The South Indian Railway Company,

LIMITED, are prepared to receive TENDERS for the SUPPLY of—

1. 100 FOUR-WHEEL STEEL BALLAST WAGONS (M.G.).
2. FOUR BOGIE PETROL TANK WAGONS (M.G.).
3. SCREWS.
4. BRUSHES.
5. LAMP FITTINGS and GLASSES.

Specifications and forms of Tender will be available at the Company's offices, 91, Petty France, Westminster, S.W. 1.

Tenders, addressed to the Chairman and Directors of the South Indian Railway Company, Limited, marked, "Tenders for Steel Ballast Wagons," or as the case may be, must be left with the undersigned not later than Twelve Noon on Friday, the 22nd February, 1924, in respect of Specifications Nos. 3, 4 and 5, and not later than Twelve Noon on Friday, the 7th March, 1924, in respect of Specifications Nos. 1 and 2.

The Directors do not bind themselves to accept the lowest or any Tender.

A charge, which will not be returned, will be made of—

£1 for each copy of Specification No. 1.
10s. ,, ,, ,, Nos. 2 and 3.
5s. ,, ,, ,, No. 4.
2s. 6d. ,, ,, ,, No. 5.

Copies of the drawings may be obtained at the offices of Messrs. Robert White and Partners, Consulting Engineers to the Company, 3, Victoria-street, Westminster, S.W. 1.

W. B. REYNOLDS,
for Managing Director.

8th February, 1924.
91, Petty France, S.W. 1. 4853

PUBLIC NOTICES

Administrative County of LONDON.

SCAVENGING, &c., THAMES EMBANKMENTS AND BRIDGES.

The London County Council invites TENDERS for the SCAVENGING, &c., of the THAMES EMBANKMENTS and BRIDGES for a contract for twelve months commencing 1st April, 1924.

Persons desiring to submit Tenders may obtain the form of Tender, &c., on application to the Chief Engineer at The Old County Hall, Spring-gardens, S.W. 1, upon payment of the sum of £5. This amount will be returnable only if the tenderer shall have sent in a bona fide Tender, and shall not have withdrawn the same. Full particulars of the work may be obtained on personal application, and the contract documents may be inspected before the payment of the fee.

No Tender received by the Clerk of the Council at the County Hall, Westminster Bridge, S.E. 1, after 4 p.m. on Monday, 25th February, 1924, will be considered.

The Council does not bind itself to accept the lowest or any Tender.

JAMES BIRD,
4849 Clerk of the London County Council.

Administrative County of LONDON.

GENERAL WORKS AND REPAIRS.

The London County Council invites TENDERS for the EXECUTION of GENERAL WORKS and REPAIRS (including Jobbing Works), exclusive of works of a mechanical character, to Sewers, Engine-houses, Buildings, Bridges, Subways, Tunnels, &c., under the supervision of the Chief Engineer of the Council, on a schedule of prices for a contract for twelve months commencing 1st April, 1924.

Tenders are asked:—(a) For the whole of the works on both sides of the river Thames; (b) for the works on the north side of the river Thames, but including Thames bridges and tunnels; and (c) for the works on the south side of the river Thames only.

Persons desiring to Tender may obtain the schedule of prices, form of Tender, &c., on application to the Chief Engineer of the Council at the Old County Hall, Spring-gardens, S.W. 1, upon payment of the sum of £3. This amount will be returnable only if the tenderer shall have sent in a bona fide Tender, and shall not have withdrawn the same. Full particulars of the work may be obtained on personal application, and the contract documents may be inspected before the payment of the fee.

No Tender received by the Clerk of the Council at the County Hall, Westminster Bridge, S.E. 1, after 4 p.m. on Monday, 25th February, 1924, will be considered.

The Council does not bind itself to accept the lowest or any Tender.

JAMES BIRD,
4855 Clerk of the London County Council.

Administrative County of LONDON.

REMOVAL OF SEWER DEPOSIT.

The London County Council invites TENDERS for the REMOVAL and DISPOSAL of SEWER DEPOSIT and other MATERIAL in connection with the Main Drainage, &c., Services for four districts—two north of the Thames and two south of the Thames, east and west respectively, for a contract for twelve months commencing 1st April, 1924.

Persons desiring to Tender may obtain the schedule of prices, form of Tender, &c., on application to the Chief Engineer at the Old County Hall, Spring-gardens, S.W. 1, upon payment of the sum of £1. This amount will be returnable only if the tenderer shall have sent in a bona fide Tender, and shall not have withdrawn the same. Full particulars of the work may be obtained on personal application, and the contract documents may be inspected before the payment of the fee.

No Tender received by the Clerk of the Council at the County Hall, Westminster Bridge, S.E. 1, after 4 p.m. on Monday, 25th February, 1924, will be considered.

The Council does not bind itself to accept the lowest or any Tender.

JAMES BIRD,
4851 Clerk of the London County Council.

South African Railways and Harbours Administration.

ELECTRIFICATION OF GLENCOE-MARITZBURG SECTION.

COLENSO POWER STATION.

The South African Railways and Harbours Administration REQUIRE the SERVICES of TWO ENGINEERS to TAKE Charge of the Operation of their Power Station at Colenso, containing 60,000 K.W. of plant, as (1) Resident Engineer and (2) Combustion Engineer.

Applicants must have experience of the operation of large Modern Power Stations, and must be medically fit. Apply before 19th February, with copies only of testimonials, to Messrs. MERZ and MCLELLAN, 32, Victoria-street, Westminster, S.W. 1, or to Messrs. MERZ and MCLELLAN, care of the General Manager, South African Railways and Harbours Administration, Johannesburg, South Africa. 4852

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SITUATIONS OPEN

WANTED, EXPERIENCED AUTOMOBILE MECHANIC to Take Charge of Car Overhaul Shops. Must have had wide general experience, and be of good education. May be required to prepare estimates for complete overhauls, and to interview customers. Commencing salary £250.—Address, 4834, The Engineer Office. 4834 A

WANTED, in Large Structural Works, South Wales, ASSISTANT to WORKS MANAGER; young, energetic, with experience of work in Constructional Shops, and suitable technical knowledge.—Address, stating age, experience, qualifications, whether married or single, &c., 4754, The Engineer Office. 4754 A

WANTED, TWO First-class MEN for ESTIMATING and RATE-FIXING; used to Instrument Work and Tool Making. Only those with a thorough practical experience and accustomed to Laying Out Sequence of Operations and Speeds and Feeds need apply. State age, experience, and salary required.—Address, 4801, The Engineer Office. 4801 A

ARTESIAN WELL ENGINEERS REQUIRE at once practical experienced OUTSIDE MAN, to supervise Well Sinking, Hooping and Boring Jobs.—State age and full details of experience to LE GRAND, SUTCLIFF, Southall, London. 4876 A

ENGINEER TO TAKE CHARGE OF STAND AT WEMBLEY EXHIBITION.—ENGINEER, Friday, January 11th, 1924, No. 4580.—ADVERTISERS wish to THANK all APPLICANTS for the above POST, which has now been FILLED. 4504 A

REQUIRED, First-class ENGINEER, for Erection of all classes of Woodworking Machinery. Previous experience absolutely essential. Permanent situation and good wages to suitable man. Send copies of references and wages required.—Address, 4836, The Engineer Office. 4836 A

REQUIRED for South America, a CHARTERED CIVIL ENGINEER to Take Charge under Chief Engineer of Preparation Plans and Construction of large Terminal Station. Work will last several years. Applicants must have good experience of this class of work, and not be less than 25 years of age.—Apply, with full particulars, and stating salary required, to Box "STATION," c/o Davies and Co., 95, Bishopsgate, E.C. 2. 4860 A

REQUIRED, Two First-class REPRESENTATIVES, one for Northern Counties, one for London and Eastern Counties, for sale of High-class Woodworking Machinery. Must have had previous experience. Every opportunity to suitable salesman. Send particulars and copies of references.—Address, 4837, The Engineer Office. 4837 A

WANTED, DRAUGHTSMEN for Light Railway and Heavy Wagon Work; capable of design and estimate; knowledge of Structural Work preferred. State experience, salary, &c.—Address, 4867, The Engineer Office. 4867 A

WANTED, DRAUGHTSMAN; must have several years' experience of Reinforced Concrete Design. —Apply, by letter, stating age, qualifications, and salary required, to The SECRETARY, The British Reinforced Concrete Engineering Company, Ltd., 1, Dickinson-street, Manchester. 4800 A

WANTED, DRAUGHTSMEN with Knowledge of Conveyors; temporary. State experience and alary.—Address, 4865, The Engineer Office. 4865 A

WANTED, DRAUGHTSMAN, with Good Experience in Steam, Electric Winches and Crane Design, also Structural Steel Work, for Engineering Works near Ipswich. State experience and salary required. —Address, 4846, The Engineer Office. 4846 A

WANTED, ENGINEER DRAUGHTSMAN for Plant Maintenance; must have held similar position. State experience, salary, &c.—Address, 4869, The Engineer Office. 4869 A

WANTED, First-class DRAUGHTSMAN for Structural and Mechanical Work on Coal and Coke-handling Machinery. Good structural experience essential.—Reply, giving full particulars, including age and salary required, to STRACHAN and HENSHAW, Limited, Engineers, Bristol. 4839 A

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SITUATIONS WANTED (continued)

ENGINEER, A.M.I.C.E., A.C.G.I. (30), Single, Experience refrigerating, surveying, 9 years with firm machinery exporters, thorough knowledge machine tool business; languages French, German, Portuguese, SEEKS CHANGE, home or abroad.—Address, P8655, The Engineer Office. P8655 B

ENGINEER-MANAGER, of Proved Ability, OFFERS his SERVICES as Manager, Departmental Manager, or similar responsible Position. Important executive positions held for past twelve years; discharged; progressive firms interested.—Address, P8632, The Engineer Office. P8632 B

ENGINEER MANAGER or SUPERINTENDENT, mechanical, marine, or industrial engineering, English (30), single. Accustomed to tackle and put over hard jobs under difficulties. Good organiser and executive; taet, energetic, hard worker. Several years' experience design, construction and operation, oil refineries, ships and machinery and general engineering plants. Superintendent shipping co.'s and Lloyd's surveyor. Complete control large staffs and labour, knows how to obtain best results. Fluent Spanish, Italian, French and other languages. M. Inst. N.A., &c. Excellent refs. Open to ACCEPT POSITION anywhere after Feb. 15, 1924.—Address, P8608, The Engineer Office. P8608 B

ENGINEER (30), Technical College Training, Experience erection and maintenance of boilers, turbines and reciprocating engines, refrigeration and electrical plant. First-class B.O.T. certificate. Trained and experienced in engineering salesmanship. SEEKS APPOINTMENT, preferably sales or plant maintenance.—Address, P8612, The Engineer Office P8612 B

ENGINEER (25), 12 years' Thorough All-round experience, apprenticeship, managerial exp., college trained, degree, REQUIRES POST as Engineer Works Manager or Assistant to either.—Address, P8649, The Engineer Office. P8649 B

ENGINEER (30) SEEKS SITUATION, any Capacity. Five years' apprenticeship and technical. Wide all-round mechanical experience, erection and maintenance of boilers, turbines, reciprocating engines, refrigeration and electrical plants, &c.—Address, P8666, The Engineer Office. P8666 B

ENGINEER (43), B.Sc., A.M.I.E.E., Wide Electrical experience, 10 years charge electrical installation on large chemical works, used to lay out, operate and maintain A.C. and D.C. plant, some years commercial experience, DESIRES APPOINTMENT.—Address, P8601, The Engineer Office. P8601 B

ENGINEER (48), Experience, 15 Years Designing, testing, experimenting, works management, manufacturing road transport vehicles, 9 years own business, and on directorate road transport concern. POSITION WANTED.—Address, P8627, The Engineer Office. P8627 B

ENGINEER SEEKS POSITION as Representative at home, abroad, or REPRESENT FIRM at WEMBLEY. Age 48, well educated, good address, energetic, tactful, knowledge and practical experience heavy oil, steam reciprocating, and turbine machinery, hydraulic pumps, air compressing and refrigerating plants, various types power transmission; charge of machinery afloat, 30,000 H.P.; 14 years' engineer, surveyor, and office work; fluent French.—Address, P8634, The Engineer Office. P8634 B

ENGINEER'S STOREKEEPER SEEKS SITUATION; many years' experience in motor industry, conversant with up-to-date methods, keen organiser.—F. J. HILL, 6, Nightingale-road, Guildford. P8643 B

ENGINEERS' TRAVELLER (36) DESIRES CHANGE. Structural steel work, forging, boilers and mechanical handling plants. Good sales and practical experience.—Address for details, P8663, The Engineer Office. P8663 B

ESTIMATOR, Rateiser, Planner, &c., REQUIRES POSITION. Sound practical man, with initiative. Ten years' experience light and heavy tooling, fitting, toolmaking, &c. Accustomed to mass production and general engineering on up-to-date methods. Refs.—Address, P8610, The Engineer Office. P8610 B

GENTLEMAN, M.I. Mech. E., SEEKS POST as Engineer Representative to firm of repute. Proved ability in sales, design and works; North of England, preferably Lancashire and Yorkshire, over which districts he is well known and has excellent connection. Salary, expenses.—Address, 4863, The Engineer Office. 4863 B

MECH. ENGINEER (35), Public School Type, 10 years' shops, D.O. and technical training, 11 years' Indian experience, holding good positions with Government and commercial firms, DESIRES POST abroad as Foreign Representative or Engineer to British firm.—Address, P8633, The Engineer Office. P8633 B

M.I. MECH. E., 24 Years' Experience Engines and pumps, SEEKS responsible POSITION, or would consider WEMBLEY EXHIBITION APPOINTMENT.—Address, P8628, The Engineer Office. P8628 B

STRUCTURAL ENGINEER (35), A.M.I.C.E., B.Sc., &c.; speciality—REINFORCED CONCRETE CONSTRUCTION; 8 years' experience in Far East (including commissioned service in R.E.), SEEKS EMPLOYMENT at home or abroad.
Excellent testimonials and references on application to P8635, The Engineer Office. P8635 B

MINING and METALLURGICAL ENGINEER, broad commercial and technical experience Russia, U.S., Asia, SEEKS CONNECTION British concern, Europe or Russia. Thirty-nine years of age, naturalised American; speaks Russian and French; present location Asia. List of references Engineer Office. Will report duty thirty days receipt firm offer.—Address, 4852, The Engineer Office. 4852 B

PRODUCTION SPECIALIST, Designer Jigs, Tools, practical toolmaker, long experience motors, aircraft fittings, SEEKS APPOINTMENT in South of London.—Address, 4854, The Engineer Office. 4854 B

SUGAR and TANNIN ENGINEER REQUIRES POSITION as Manager or Manufacturing Expert; recently returned from India; excellent testimonials, home or abroad.—E. BURFORD, 20, Caterham-road, Lewisham, London, S.E. P8641 B

WATERWORKS EXPERIENCE WANTED by O. I. Mech. E. Nominal salary.—Address, P8667, The Engineer Office. P8667 B

WORKS MANAGER. Having Upwards of 20 Years' practical and commercial experience in steel mills and forgings with modern plant, with heavy output, is DESIROUS of CHANGE and OPEN to ENGAGEMENT.—Address, P8645, The Engineer Office. P8645 B

YOUNG ENGINEER, Fully Trained, REQUIRES APPOINTMENT at Home or Abroad; good testimonials and reference.—P. H., W. H. Smith and Son, Bookstall, Basingstoke. P8625 B

AUTOMOBILE.—CHIEF DRAUGHTSMAN and DESIGNER in the employ of a prominent firm of motor car manufacturers DESIRES a CHANGE.—Address, P8638, The Engineer Office. P8638 B

DRAUGHTSMAN (Junior), SITUATION WANTED; Borough Polytechnic experience; age 17 years. —Letters addressed to C. SIMPSON, 52, Park-crescent, Clapham, S.W. 4. P8629 B

DRAUGHTSMAN (21), at Present Disengaged, SEEKS POST. Last two years with constructional engrs.; also 3 yrs' previous D.O. exp.—P. G., 25, Junction-road, Highgate, N. 19. P8661 B

DRAUGHTSMAN (29) SEEKS CHANGE of SITUATION; permanency; good general experience, including jigs, fixtures, I.C. engines, transact patent business, mathematics, mechanics.—Address, P8639 The Engineer Office. P8639 B

For continuation of Small Advertisements see page 3.

A Seven-Day Journal

Carrier Wave Telephones at a Colliery.

IN a paper just published in the "Proceedings" of the South Wales Institute of Engineers on "A Modern Colliery Plant," Mr. Edmund Hann refers to an interesting telephone system which has been put into use between Bargoed and Llantrisant, South Wales. Telephone lines run on the main transmission poles have not, the author states, proved satisfactory in this country, whilst separate pole telephone lines have the disadvantage that they are mechanically weaker than the transmission line itself, and, therefore, more liable to damage in storms. Underground cables involve enormous expense, and connections with Post Office trunks result in delay. The equipment described in this paper, however, works on the high-frequency carrier current principle, and it overcomes all the difficulties. High-frequency waves are generated in the usual wireless telephony apparatus by a thermionic valve with a tuned anode circuit. A second valve has its grid connected to a microphone, and its anode is coupled to the grid of the first valve. Speech waves are superimposed on the high-frequency waves and the whole transmitted to an aerial, which is inductively coupled to the high-tension lines. The high-frequency waves pass along the high-tension wires and are transmitted to a similar aerial at the other end of the line, where there is an ordinary valve receiving set.

Automatic Railway Couplings.

So little headway seems to be made with the adoption of automatic railway couplings in France that the railwaymen themselves are making an effort to get a suitable system imposed by the League of Nations. Following upon the trials carried out in France after the Armistice with systems that, while not being perfect, appeared sufficiently satisfactory until something better could be found, a number of trucks and coaches were equipped on the State railways with automatic couplings on the Boirault and Henricot systems. During the past week a deputation from the International Federation of Railwaymen, the headquarters of which are at Amsterdam, with representatives of other bodies, witnessed the operation of the Boirault couplings on trains at La Rochelle, and so satisfied were the railwaymen's representatives with the results that a report has been sent to the International Labour Bureau in Geneva in favour of the League of Nations taking measures to ensure the coupling's immediate adoption. The cost of equipping the whole of the railway coaches with a particular system of automatic coupling would be so enormous that the companies cannot risk this expenditure except by gradually extending the trials, as they are doing at present. The time certainly does not seem to have arrived when the question of automatic couplings can be taken up by the League of Nations, except, it may be, in the way of collating international experience and of promoting further competitive tests.

The Passing of H.M.S. Lion.

IT is announced that H.M.S. Lion is to be broken up at Blyth, the work having been allotted to that district by the Admiralty in response to the Mayor's appeal for assistance in coping with local unemployment. This vessel was lately restored to the disposal list, from which, it will be recalled, she had been temporarily withdrawn early last year in consequence of the delay which occurred in the scrapping of warships by other Powers signatory to the Washington covenant. With the dismantling of the Lion this country will have fulfilled its obligations under the Treaty, so far as the deletion of naval *matériel* is concerned. Laid down at Devonport in November, 1909, and launched in the August following, this famous battle-cruiser began her trials at the end of 1911. It was found, however, that the heat and gases from the first funnel, which then stood immediately forward of the tripod mast, made the foretop untenable. To remedy this defect the ship underwent a partial reconstruction, the first funnel being placed abaft the tripod and various other alterations made, at an additional cost of £60,000. On her trials the Lion developed 73,802 shaft horse-power, corresponding to a speed of 27 knots, a performance she subsequently improved upon. Displacing 7500 tons more than the preceding class of battle-cruiser, and armed with eight 13.5in. guns, the ship, on her final completion in June, 1912, was the most powerful unit of her type afloat at that date. On March 1st, 1913, she became the flagship of Rear-Admiral David Beatty, commanding the 1st Cruiser Squadron, and continued in that *rôle* until November, 1916, when Admiral Beatty was appointed Commander-in-Chief, Grand Fleet. The Lion was heavily engaged both in the Dogger Bank and the Jutland actions. In the former engagement she was disabled by enemy gunfire, her armour being holed below the waterline. At Jutland she was hit twelve times by heavy projectiles, her casualties numbering 144, including 95 killed. One shell, bursting in "Q" turret, ignited cordite charges in the hoist, and the ship would almost certainly have blown up but for the presence of mind and devotion of Major F. J. W. Harvey, R.M.L.I., officer of the turret, who, in spite of a mortal wound, passed the word below to close the doors and flood the magazines.

New Chief Constructor at Hong Kong.

IN our issue of January 18th we had to record the death but a week earlier of Mr. A. J. Hobson, the Chief Constructor at the Government Dockyard at Hong Kong. According to the *Journal of Commerce*, the Admiralty has been very prompt in selecting his successor. It is reported that the choice has fallen on Mr. J. S. Gillingham, who has for the past three years occupied the post of Senior Constructor at Devonport. Just before the beginning of the war Mr. Gillingham was Admiralty overseer during the construction of Audacious, which was built by Cammell Laird and Co., Limited, at Birkenhead. He was later on the designing staff, and then at Pembroke and Portsmouth before going to Devonport.

Electrical Research.

THE third annual report of the British Electrical and Allied Industries Research Association has recently been issued. The most noteworthy development of the year which the report covers, namely, 1923, was the formation of a class of associate members embracing suppliers and users of electricity. Early in the year the Association was faced with the necessity of raising additional funds for important researches on the phenomena of switching and arcing, so that advantage might be taken of exceptional facilities offered by the Newcastle Electric Supply Company, Limited. Substantial help was obtained from the larger electric supply undertakings and from the railway groups, and this assistance, supplemented by special subscriptions from interested manufacturers, enabled the work to be undertaken on an adequate scale. From the report it appears that a considerable amount of other useful work is being carried out, and it is to be hoped that the Association will continue to receive all the financial backing that it requires.

Heavy Oil Engine Working Costs.

IN the recently issued report prepared by the hon. secretary of the Diesel Engine Users' Association, reference is made to the work the Association has done in tabulating information relating to the average working costs of a representative group of heavy oil engines. The figures for the year 1921, which were discussed at a meeting in March last, shows that in that year the cost of producing one unit was 1.086 pence per unit, while with corrections made for the prices of materials and labour, the cost in March, 1923, was 0.789 pence per unit. In 1921 the cost of fuel oil per unit generated was 0.53 pence and the average quantity of fuel oil consumed per unit generated was 0.67 lb. A meeting of the Association to discuss a further report on later 1922–3 costs will be held on February 15th. The report further refers to the suggestion put forward in our leading article of August 17th last year that there is urgent need for a systematic investigation into the working costs of marine oil engines on lines similar to those adopted by the Diesel Engine Users' Association for land-power plants.

A Smokeless Fuel Scheme.

IN the year 1910 the Corporation of Glasgow appointed a Gas Sub-committee to deal with the question of smokeless fuel, with the object of creating a purer atmosphere throughout the city. According to the *Glasgow Herald*, this Committee on Friday last agreed to proceed with a scheme for the installation of a five-unit battery of Maclaurin producers for the manufacture of smokeless fuel at the Dalmarnock gasworks. The plant, it is understood, will be capable of carbonising 35,000 tons of coal yearly, and estimates for it have already been accepted. It is anticipated that the smokeless fuel produced will be sold at about the same price as coal, and that its heating value will be approximately equal to that of coal. The gas produced in the process is to be used for boiler firing, and there are, it is reported, several new and interesting by-products which will be dealt with by the chemical section of the Corporation gas department.

The Airship Dixmude.

THE inquiry which has been made into the loss of the French airship Dixmude seems to have established beyond all doubt that the ill-fated vessel was caught in a storm on December 21st last off the southern coast of Sicily and was struck by lightning. The few charred remains that have been recovered showed that the airship had been destroyed by fire. A wireless message had been previously picked up from the Dixmude stating that the aerial was being dismounted as a measure of security. In its report, the Commission states that the responsibility for the disaster has to be sought for in too high a sphere to allow of its fixing the blame upon anyone. This remark is supposed to mean that the Dixmude was recognised to possess many defects as regarded not only its condition, but also its general design and equipment, which should have prevented its being navigated except in the most favourable circumstances. The greatest responsibility rests with those who sent the Dixmude on a cruise at a time of the year when the weather conditions are particularly uncertain. The disaster has so profoundly influenced the public mind that the Government is determined to throw the fullest light on the matter, and has appointed a further Commission, composed of the highest naval and military authorities, who will be required to fix the blame upon those who sent on a long and dangerous cruise an airship which the unfortunate commander himself had previously declared was, in executing such a task, incurring an unnecessary risk.

The Third Faraday Medal.

AT the last meeting of the Institution of Electrical Engineers, held on Thursday, January 31st, the President announced that the Council had decided to award the third Faraday Medal to Dr. Ferranti. The Faraday Medal constitutes the highest honour the Institution can confer upon an engineer for distinguished service, and in view of the great influence Dr. Ferranti's early work had upon electrical development, he is eminently worthy of the award. Dr. Ferranti was, of course, the pioneer in high-tension work. His proposals met with much adverse criticism, both in this country and abroad, but when the advantages of high pressure working were demonstrated at Deptford, the system was very quickly adopted elsewhere.

Suction Gas Tractors.

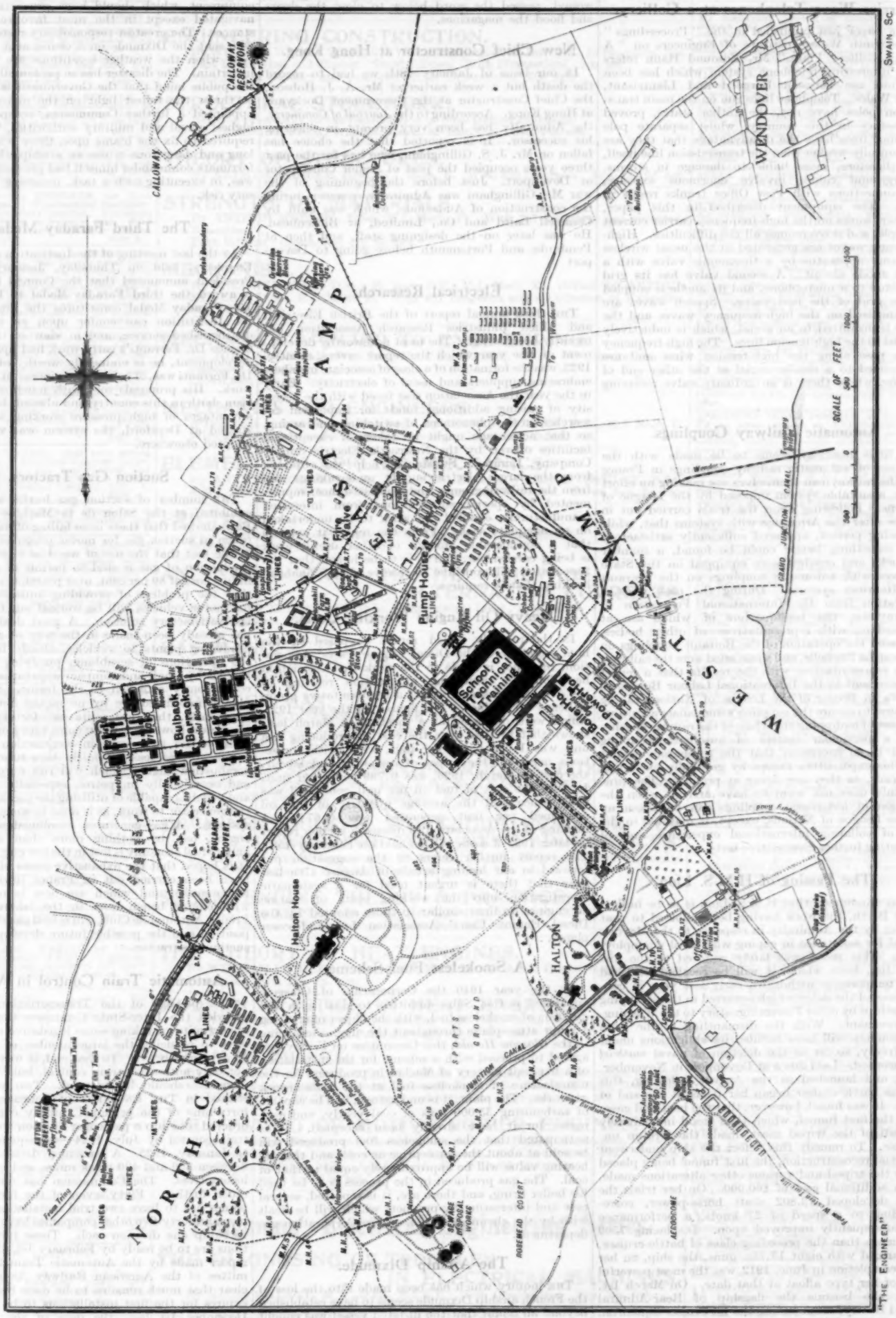
THE number of suction gas lorries and tractors exhibited at the Salon de la Machine Agricole in Paris showed that there is no falling off in the interest taken in suction gas for motor propulsion. In view of the fact that the use of wood or charcoal for the production of gas is said to permit of an economy in fuel cost of 80 per cent. over petrol, it seems certain that the problem of providing suitable generators for motor vehicles will be worked out to a more or less satisfactory solution. A good deal of progress has already been made in the way of adapting gas producing plants to vehicles, chiefly in separating the operations of scrubbing, purifying and cooling the gas by small and compact apparatus that can be conveniently attached to the frame. Some of the plants now fitted are by no means obtrusive, and, apparently, they are quite satisfactory. The gas generator, however, cannot come into general employment unless it is used in conjunction with a gas engine, or, at least, a fairly slow-running internal combustion engine which will run normally on gas and occasionally on petrol, especially for starting, and which is capable of utilising the suction for getting the generator to work, as is done in some of the latest systems. A gas generator, combined with a petrol engine, can be nothing more than a makeshift, and its fuel economy is lost in the low engine efficiency. It is hoped that the exhaustive series of trials which have been carried out in France during the past few months, and which are now being completed with engine bench tests in the laboratory of the French Automobile Club, will reveal clearly the present position and the possible future development of the suction gas tractor.

Automatic Train Control in America.

THE passage of the Transportation Act, 1920, afforded the Inter-State Commerce Commission an opportunity of taking some legislative action with a view to reducing the large number of accidents on American railways. To that end, it was ordered that not only automatic train control, but "other safety devices" should be adopted. Two years ago, as related in THE ENGINEER of February 3rd, 1922, forty-nine of the principal railway companies were ordered to equip a passenger division with automatic train control by July, 1924—subsequently extended to January, 1925. A passenger division consists of between 300 and 400 track miles, and has about 100 locomotives. The Commission has now gone very much further. Forty-seven of the forty-nine companies are to have two trial installations instead of one, and forty-five other companies have been ordered to equip one division each. These further installations are to be ready by February 1st, 1926. From a report made by the Automatic Train Control Committee of the American Railway Association, it is clear that much remains to be done before the time expires for the first installations to be ready, as on December 1st last—the date of the report—only twenty-nine out of the forty-nine companies had selected the particular installation which they were going to try. Not one of these installations, it is remarkable to relate, is of the ramp type, as used on the Great Western Railway and in France, but all are to be actuated by induction—sixteen by continuous induction and thirteen by intermittent.

HALTON CAMP TRAINING CENTRE FOR AIRCRAFT APPRENTICES

(For description see opposite page.)



Training of Aircraft Apprentices at Halton Camp.

No. II.*

HALTON CAMP.

Halton Camp, which is traversed from end to end by an old Roman road—the Upper Icknield Way—which connects Wendover with Ivinghoe and Luton in its course to the East Coast, is situated on the north-western slopes of the Chiltern Hills just where the latter fall away to form the vale of Aylesbury. That town is some four or five miles away, and is visible from the higher parts of the camp. In elevation the site varies between about 400ft. and 600ft. above sea level, and the position is undoubtedly most healthy, more especially as it possesses the advantage of an ample supply of excellent and comparatively soft—6 deg., so we understand—water which is obtained from the mains of the Chiltern Hills Water Company.

The camp—a plan of which is given on page 138—occupies a portion of what is known as the Halton estate, which, in all, spreads over an area of some 1854 acres. The mansion, Halton House, which was originally one of the country residences of the late Mr. de Rothschild, has been converted into an officers' mess, the original arrangement of the rooms and the original decorations, some of them of the most ornate character, having been retained. Some of the huts in which the men were originally housed have been disposed of, but very large numbers still remain, and it cannot be said that either they or the new barracks enhance the appearance of what was once one of the beauty spots of Buckinghamshire. It is not, however, expected of either barracks or camps that they should be beautiful. The main question is, Do they serve their purpose efficiently? and, so far as concerns the new barracks, it can be unhesitatingly said that they do. They are replete with comforts, and everything which would add to the welfare of their inhabitants seems to have been thought of and provided for, in what would appear to be as inexpensive a manner as possible, though eminently efficient.

BULBACK BARRACKS.

Bulback Barracks, so called from their close proximity to a copse known as Bulback Covert, have been built on sloping ground to the east of the camp, and the highest point touched is on the 565ft. contour line. Their position may be observed in the centre at the top of the drawing on page 138, which shows a general lay-out of the whole camp. They consist of sixteen separate blocks of buildings, all of them identical in size and general arrangement, with, in addition, (*a*) two two-storey combined dining-rooms and cook houses, one for each eight blocks of barrack buildings, (*b*) two regimental institutes, (*c*) two sergeants' mess buildings, and (*d*) a special block, which contains a medical examination department, dispensary, stores, &c. The main blocks, which are red-brick structures with slate roofs, each contain a basement and three upper storeys, the latter being each divided into two dormitories, so that in the sixteen buildings there are, in all, ninety-six dormitories, each containing twenty-two beds, including one for the corporal or leading boy who is in charge of the dormitory and has a separate cubicle partitioned off from the main room. The whole of each floor, comprising two dormitories and ablution rooms, &c., is under the supervision of a sergeant, who is accommodated in a room just outside the dormitory. The buildings as a whole will therefore accommodate a total of 2112 boys. Each dormitory is 66ft. in length by 20ft. wide and 10ft. 6in. high. It has six windows in each side and one window at one end, the entrance door being in the centre of the wall at the other end. It will therefore be seen that each room has a capacity of 13,860 cubic feet, which allows 630 cubic feet for each inmate. The beds, which are in two rows with a central gangway between them, have iron frames and steel spring mattresses, and are arranged at right angles to the centre lines of the buildings with their heads next the walls, as will be seen in Fig. 4 p. 138. Attached to the wall at the head of each bed there is a sheet steel locker for holding clothes and other property. Heating is effected by two rows of hot water pipes, about which we shall have more to say later, and ventilation is assured by making it impossible entirely to close a certain number of the windows.

The lavatory and sanitary arrangements are of the most complete type. To each floor, containing two dormitories, there are assigned one enamelled bath, two separate shower baths, both furnished with hot and cold water, and eight wash-hand basins. There are also four water-closets of the open type—wood cleats taking the place of the more usual lifting seats—and two glazed fire-clay urinals. A highly appreciated adjunct is a water-heated, fan-ventilated chamber where wet clothes may be hung and rapidly dried.

HEATING ARRANGEMENTS.

The heating of all the buildings is effected by means of hot water, which is produced in a small boiler-house adjacent to building No. 9 in the plan. There are three boilers, all of the dry-back return-tube type, two, each with two furnaces, measuring 8ft. in diameter by 14ft. long, and one, with one furnace, measuring 6ft. 6in. in diameter by 12ft. 6in. long. All are hand fired, and the working pressure is 100 lb. per square inch. The boiler water is not circulated directly through the buildings to be heated, but is used to heat the circulating water in five insulated and steel-lagged calorifiers, arranged in a room adjacent to the boiler-house—see Fig. 1. Each of these calorifiers has a maximum capacity of 12,500 gallons of water per hour, heated to a temperature of 195 deg. Fah., with water having an initial temperature of 165 deg. Fah. The water so heated is circulated through two sets of mains, one being for the east block of buildings and the other for the west block, by means of steam turbine-driven centrifugal pumps. The mains, which are 7in. in diameter at the boiler-house, and progressively reduced to 2½in., are 1000ft. and 1200ft. long respectively. Each main is furnished with a Venturi cone by means of which, in conjunction with a column of mercury, and a calibrated scale, it is possible to read at any instant the volume of water flowing, in terms of gallons per minute.

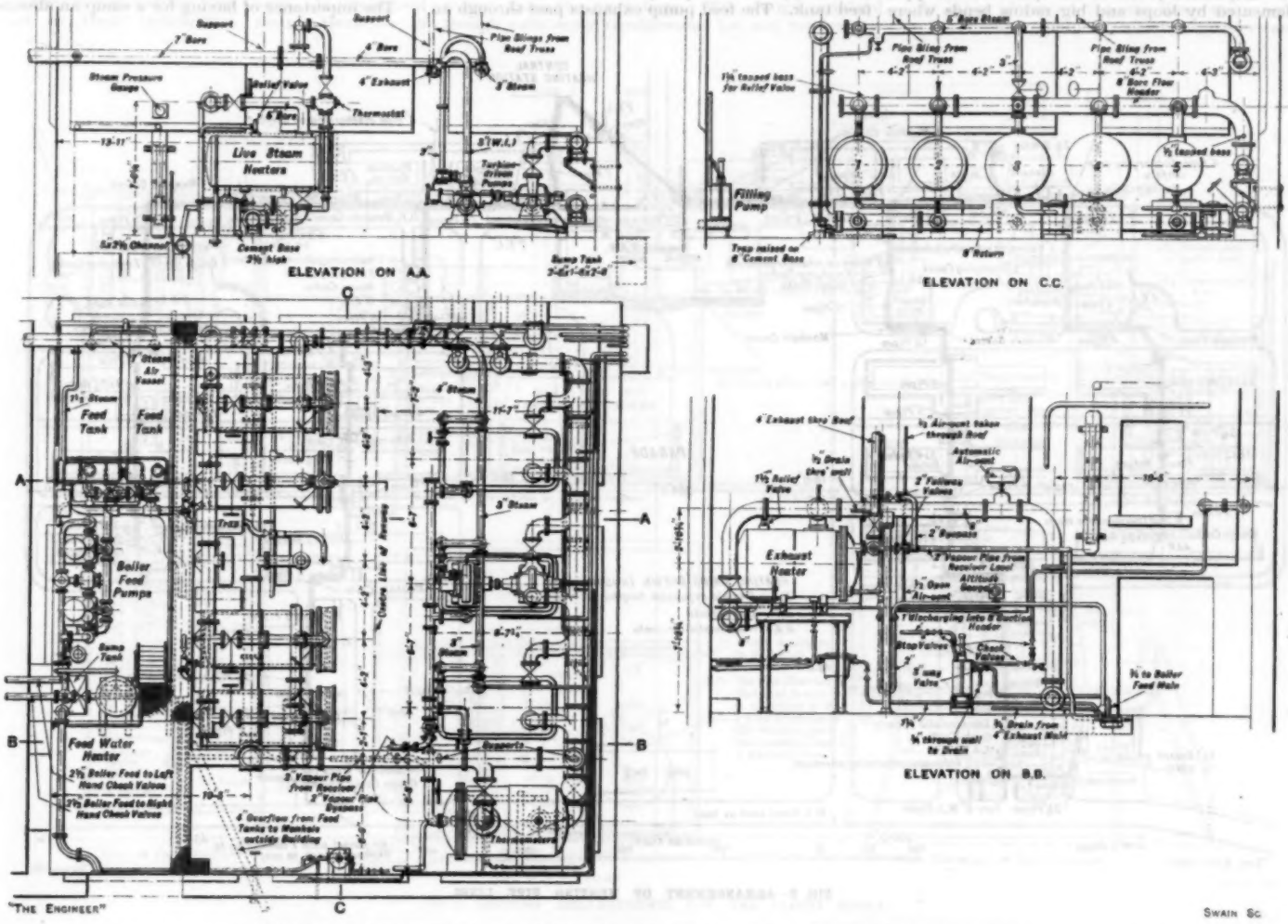


FIG. 1—PLAN AND SECTIONS OF CALORIFIER AND PUMP ROOM IN CENTRAL HEATING STATION

Thermometers are also arranged in the outgoing and incoming pipes, so that the drop of temperature can be read at any moment. The thermometers are of the recording type, so that the variations over any given time may be observed. There are three circulating pumps, each capable of delivering 600 gallons of water per minute. The exhaust steam from all of them is led to a calorifier, which acts as a condenser, the condensate flowing to the hot wells, from which the boiler feed water is taken. There are two vertical type feed pumps, the exhaust from which is taken to a feed-water heater.

Pump Sets.—Each pump set consists of a centrifugal pump, direct coupled to a steam turbine, both mounted on a common bed-plate, and delivering 600 gallons per minute at 1000 revolutions per minute. The pump bearings are external, independent of the stuffing-boxes, white-metal lined, and are provided with oil ring lubricators. The turbines are of the impulse type, with a governor keeping the speed within 5 per cent. of that for which it is set, from no load to full duty. A hand adjustment is provided on the governors, whereby the speed of the set may be varied while running. A further provision is a tachometer to each set.

Calorifiers.—The live steam calorifiers have mild steel bodies, cast iron tube plates, and cast steel covers. The exhaust calorifier has a mild steel body, steel tube plate and cast iron cover. Copper U tubes

* No. I. appeared February 1st.

are employed as transmission surface in each case, the surface in the exhaust calorifier being proportioned to condense the whole of the exhaust steam from the pump sets down to atmospheric pressure.

The heated water is employed, not only for heating the various buildings, but for providing hot water for the baths, &c. For some purposes it is used for direct heating, but for others it is passed through calorifiers, two of which are installed in the basement of each building. These calorifiers are of the water-to-water type, and each is designed to heat 1 gallon of water per minute to a maximum temperature of 160 deg., with an initial temperature of water of 50 deg. Fah. The main circulating pipes are very carefully lagged, and notwithstanding the great length of the mains, the loss of heat in them which is due to radiation is noticeably small. As evidence of the truth of this statement, we may say that the difference in temperature in the going and returning water on the occasion of our specially observing it, which was at such a time that but little heating work was being done, was only about 10 deg. Furthermore, we may say that a temporary office formed in one of the basements quite close to the calorifiers and considerable lengths of mains, and used by one of the maintenance staff, was by no means uncomfortably warm. Expansion joints of the spiral wound type, supplemented by loops and big radius bends where water provided for a large number of purposes. Actually, about 120 tons per month were consumed during last winter, which, however, was not of a severe character. Still, there is evidently a considerable reserve.

Heating of Two Type "F" Flight Sheds.

While on the subject of heating, we may explain that at the side of the aerodrome, the position of which will be seen on the plan, there are two "F" type flight sheds, both of which are warmed. Each shed consists of a corrugated iron and steel span roofed structure, 203ft. long, 103ft. wide and 50ft. high at the ridge, and has a "lean-to" roofed annexe, 20ft. wide and 15ft. high, extending the full length of one side of the main building. The sheds are arranged end to end, with a 50ft. space between them.

Each shed has a hot blast heating scheme identical in character, including an elevated fan chamber inside each main building, and is supplied with steam from a boiler-house situated midway in the interval between the sheds. The boiler plant—see Fig. 3—consists of two vertical multitubular boilers, 6ft. in diameter and 12ft. 6in. high, each capable of evaporating 2500 lb. of water per hour from and at 212 deg. Fah. The working pressure is 100 lb. per square inch. Two marine type vertical pumps feed the boilers from a feed tank. The feed pump exhausts pass through an arrangement, which allows the full capacity of fresh air from outside to enter the system, or the full amount to be drawn from inside the shed for re-circulation, or any degree of mixture between the two extremes. A system of galvanised steel rectangular trunking distributes the heated air throughout the shed and annexe. The shed can be maintained at the desired temperature of 47 deg. when the outside temperature is 30 deg., and the annexe at 55 deg. under similar external conditions.

The importance of keeping the body of the shed free from obstructions prevented the use of long downcomers, and the heated air is discharged at high velocity from short downcomers, spaced at intervals at a height of 28ft. above the floor level. The air issues at a velocity of 22ft. per second, which is found to be quite satisfactory.

The annexe, used as workshops, is served by a separate trunk branched from the main near the fan outgo, and provided with an auxiliary live steam heater near the branch. Downcomers deliver hot air at a velocity of 3½ft. per second from expanded outlets at a height of 2ft. above floor level, a streamlined deflector within each outlet giving a fairly even velocity over the full area of the outlet.

Water Supply.

The importance of having for a camp an abundant

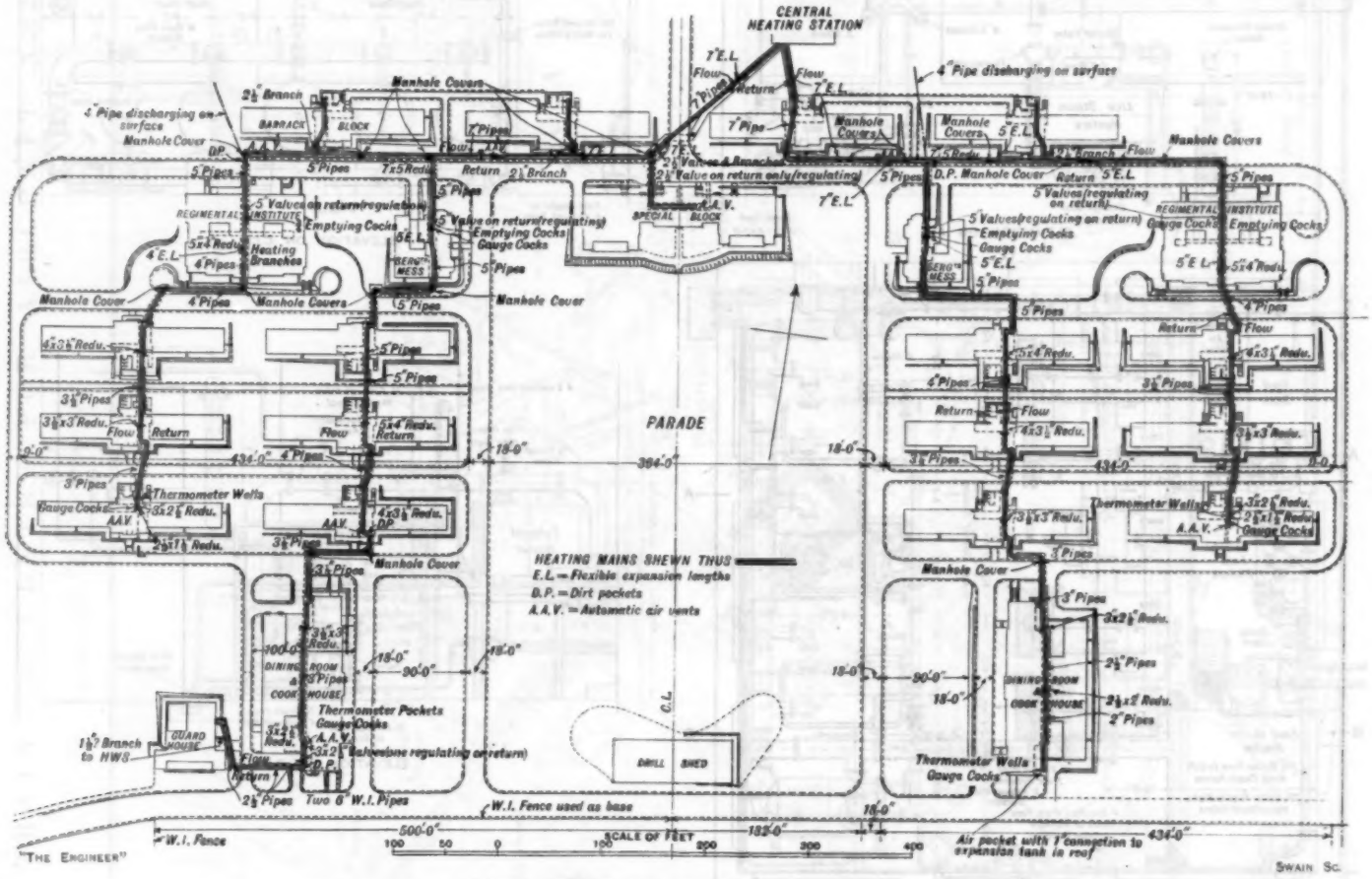


FIG. 2—ARRANGEMENT OF HEATING PIPE LINES

possible, are employed. The lagging used is 1¼in. of blue asbestos covered with canvas and painted white, and it has evidently been applied with great care. Throughout the whole installation, in fact, every precaution has been taken to conserve heat, and it must be highly efficient in operation.

The arrangement of the piping is shown in Fig. 2. The equipments of all the blocks of dormitory buildings are identical. For heating the dormitories, two sets of go-and-return pipes are led up vertically from the basement to the third-floor level. On each floor there are two complete circuits of pipes, 2in. in diameter, one set being led alongside one of the walls near the floor, while the other set occupies a similar position on the other side of the dormitory, the flow and return pipes being in each case connected together at one end by means of a U bend, and at the other being, of course, connected to the vertical supply and return pipes respectively. The three floors are therefore served in parallel from one pair of vertical mains. It will be observed that the calorifiers are not used for heating the dormitories, but are only employed for heating the water used for the baths. The aim, so far as the dormitories are concerned, has been to maintain an internal temperature of 55 deg. Fah., with a minimum external temperature of 30 deg. Fah., and we gather that it has been more than achieved. The amount of coal, which is Welsh coal and has a calorific value of some 14,500 B.Th.U. per lb., apportioned to the service of the camp is about 200 tons per month, and with it all the new buildings have to be efficiently heated and ample hot oil separator and a feed-water heater, the condensate is delivered to the feed tank, and an automatic exhaust valve to atmosphere is provided on the exhaust main near the pumps. The lagging is of blue asbestos, mattresses being used for the boilers as well as for the feed heater, and moulded sections for the pipes.

The fan chamber in each shed contains a centrifugal fan capable of delivering 30,000 cubic feet of air per minute at 90 deg. Fah. against a maintained water gauge of 1¾in. A simple vertical enclosed-type steam engine fitted with a governor and a tachometer is directly coupled to the fan, both fan and engine being mounted on a common bed-plate. Oil-fouling of the fan is prevented by a system of oil throwers and volutes. The normal speed of the sets is 500 revolutions per minute.

The main heater battery in each case is arranged on the suction side of the fan, and is of vertical tube construction, each tube end being welded to a nipple, which, in turn, is welded to an upper or lower header. The outer stacks of tubes are heated by exhaust steam from the engine, and are proportioned to condense the whole of the exhaust steam down to atmospheric pressure. An automatic exhaust valve to atmosphere is provided. The inner stacks are heated by live steam, and are valved to give a wide range of control over the amount of surface under steam, the exhaust stacks being also valved. All condensate is ultimately returned to the boiler feed tank.

Air entering the apparatus is controlled by a shutter water supply of undoubted purity is, of course, well recognised. During the war the question as to whether or not there was an adequate supply of water of the requisite purity was frequently the deciding factor as to whether a camp could or could not be formed in any given place. One of the chief things which decided the authorities in their choice of the Halton estate was that such a supply was available from, as has been said, the mains of the Chiltern Hills Water Company. Indeed, a 6in. main coming from that company's pumping station at Tring was already in existence below the surface of the Upper Icknield Way for the supply of Halton House. That pipe was extended for some distance; in fact, to a pump house which is seen on the east side of the Icknield Way, opposite the end of the road leading up past the south-west front of the School of Technical Training. From that pipe the whole of the West Camp is supplied direct, there being sufficient pressure to meet the requirements, even of the highest points. The East Camp, however, was at too high an elevation to be reached by the pressure available, and in order to furnish it with water, resort had to be made to pumping. Water is delivered through the company's main coming from Tring into a small suction tank, which may be seen in the left top corner of the plan on page 138, and the floor of which is at an elevation of 582ft. above O.D. From this tank the water is pumped by two oil engine driven centrifugal pumps each capable of delivering 18,000 gallons per hour into an adjacent reservoir at a higher level, which is known as Aston Hill reservoir, and the floor of which

is at an elevation of 635ft. above O.D., a height which is sufficient to command the highest-placed building in East Camp, including Bulback Barracks, to which the supply is taken through a 7in. main.

The supply from this source is sufficient for all ordinary purposes, but was not considered adequate in case of fire. It was accordingly decided to bring into commission another reservoir at a higher level, known as Calloway reservoir, which may be seen at the right-hand top corner of the plan on page 138. Its floor is at an elevation of 817ft. above O.D. In order to lift water into it, two motor-driven pumps, each with a capacity of 6000 gallons per hour against a total head of 350ft., were installed in the pump-house beside the Icknield Way, to which reference has already been made. The Calloway reservoir can hold 300,000 gallons, and the water is forced up to it through a 7in. main. Normally, the only domestic supply taken from it is to the isolation hospital, the draught from which is enough to ensure sweet and wholesome water being kept in the fire reservoir. In case of fire, however, the fire valve, which, as will be seen on the plan, is on a 7in. branch taken off the 7in. rising main, and which is ordinarily kept closed, is opened, and this allows the full pressure due to the elevation of the reservoir to be felt throughout the distribution mains of the East Camp. At the highest point in these distribution mains there is in

led to the works through two main sewers, that coming from the East and West Camps being 15in. in diameter and that from the North Camp 9in. in diameter. Just before it reaches the works, the 15in. sewer is joined by a 12in. branch coming from Halton House. All three sewers are led over the canal in cast iron pipes.

At the works the sewage is delivered into a detritus tank, measuring 13ft. 6in. by 6ft. by 8ft. deep, and then passes into one of four sedimentation tanks, each of which measures 80ft. long by 28ft. 6in. wide by 5ft. 6in. deep. The effluent from these tanks is passed to two circular sprinkling beds, 95ft. 6in. in diameter and 6ft. deep, and fitted with revolving sprinklers, the discharge being in its turn passed through a pair of identically sized sprinkling beds, the effluent from which is taken to either one of the three humus tanks, measuring 45ft. long by 16ft. wide by 3ft. 6in. deep. The final effluent passes as clear, non-odorous, non-putrescible liquid into a channel, through which it finds its way to a small watercourse. In no part of the works did we notice any offensive smell whatever.

The sewage is of a strong character, and is very nearly entirely of a domestic nature, though there are certain small discharges in the nature of trades wastes from the workshops. The sludge problem, though sufficiently troublesome, has not yet become

see Fig. 5, page 148—for 500 boys, a lavatory and cloak-room accommodation, and a wash-up room for pans and dishes. The kitchen—see Fig. 6—is situated on the ground floor, and is connected with the servery in the first floor dining-room by means of power-driven lifts. The boys are divided into squads, each of which is accommodated at a separate table, each table being presided over by a leading boy, whose business it is to serve the food, which is brought to him in dishes and utensils holding sufficient to give each boy an ample helping. Orderlies transfer the dishes directly to the serving tables, and since the serveries are arranged quite close to the stores and cooking ovens in the kitchen, the viands are placed steaming on the tables.

Steam ovens are employed, and to provide them with steam each kitchen is furnished with a vertical coal-fired boiler, which works at a pressure of 120 lb. per square inch. This boiler also provides hot water for washing plates, dishes, &c., modern washing machines being used.

A great deal of care is taken to prevent waste of any kind, and to recover as much grease as is possible. With this object, bones, &c., are rigorously preserved and treated by boiling to abstract the fat, both bones, grease, &c., being thereafter sold.

At other places on the site there are a bakery—see Fig. 7—and a laundry, which, we understand, are

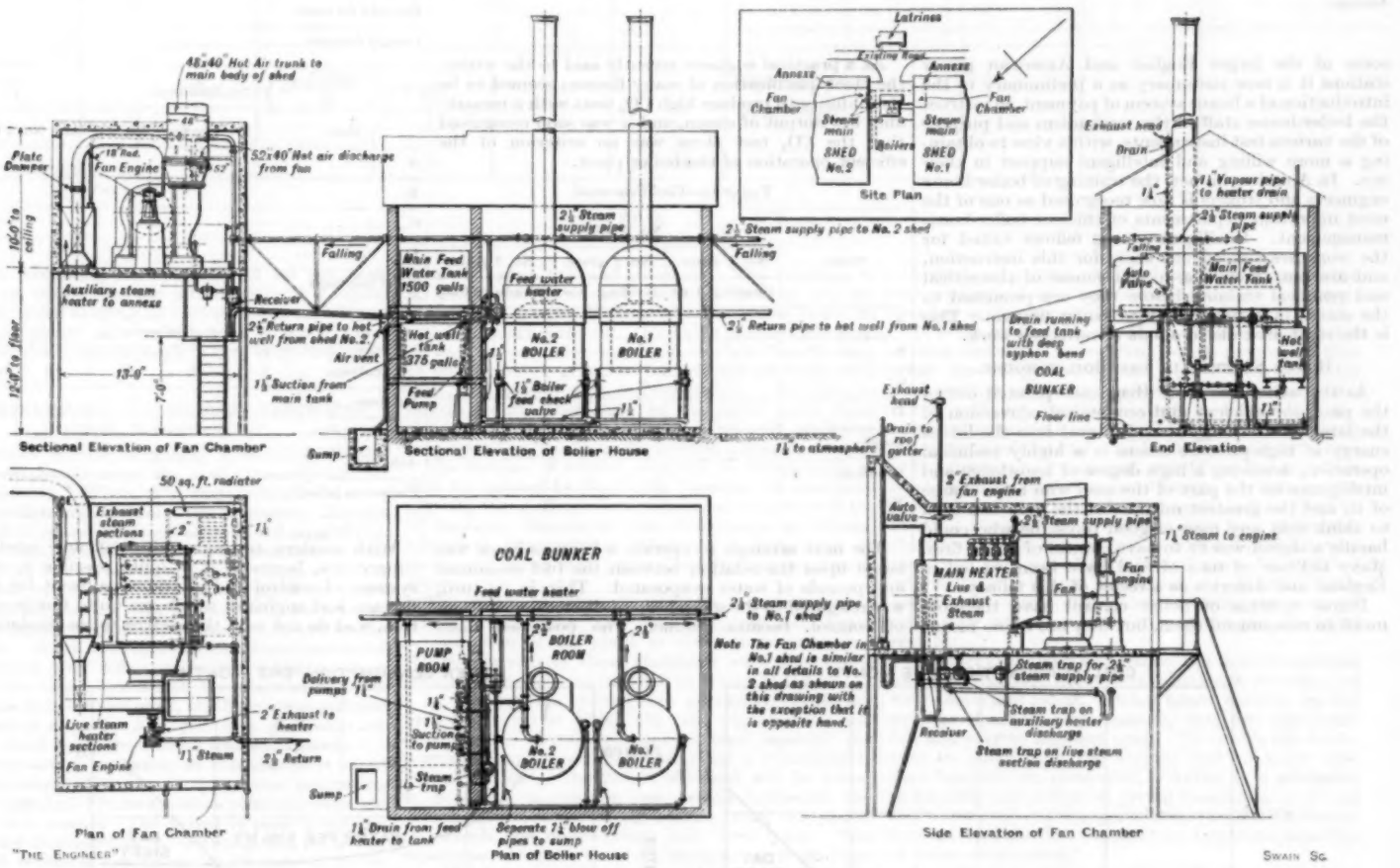


FIG. 3 HEATING ARRANGEMENTS FOR THE FLIGHT SHEDS

this manner ensured a pressure due to a head of some 250ft. of water, while in the lower portions of the camp the pressure, of course, is proportionately greater.

There is thus an excellent supply of water, both for domestic and fire-fighting purposes throughout the whole camp. The water is supplied through meters, and there is a permissible ration of an average 20 gallons per head of those in the camp, that quantity having to suffice for all purposes.

SANITARY ARRANGEMENTS.

The sanitary arrangements of the camp are of a most complete and satisfactory character. A disposal works has been formed to the north-west of the camp, on the far side of the Tring-Wendover branch of the Grand Junction Canal, a canal which is no longer in use, but through which there is a continual flow of water in the direction of Tring. The invert of the inlet to the detritus tank of the disposal works stands at 370.75ft. above O.D., which is low enough to permit of sewage to gravitate to it from all parts of the camp, saving that from the latrines at the rear of the sheds on the edge of the aerodrome to be seen in the left-hand bottom corner of the plan of the camp which is given on page 138. In that case, a small electrically driven non-automatic pump is employed to lift the sewage through a 4in. main and discharge it into one of the sewers leading to the disposal works. The lift is just over 8ft. 6in.

As will be observed from the plan, the sewage is

of sufficient moment to be serious. The sludge is disposed of by lagooning and trenching, and a certain quantity of the trenched material is taken by neighbouring farmers. The works, which were constructed with an eye to future developments, are of more than sufficient capacity to deal with the sewage at present reaching them, and well as they are operating at present, it is quite possible that they will, so far as the effluent goes, perform their duties even better when they are treating greater volumes of sewage. The sludge difficulty will, however, increase as greater numbers are accommodated in the camp, and that is a point which the authorities are keeping in mind.

MESSING ARRANGEMENTS.

In addition to provision for the comfort of the apprentices in the way of good warm dormitories, baths, &c., there are most excellent messing arrangements. For each block of eight dormitory buildings there is a well-appointed mess-house. We need not go in detail into the various types of apparatus and machinery which go to make up the kitchen equipment. It will suffice to say that it is of an entirely up-to-date character, labour-aiding appliances being employed wherever possible. A point was made of our being present when the mid-day meal was being served, and we were struck with the excellence of the fare provided and with the care taken that the food should be placed hot on the table. There are two floors, each of which comprise a dining-room—

capable of meeting the needs of the whole camp. We did not, however, have an opportunity of visiting either establishment.

Modern Systems of Boiler Control.

By JOHN B. C. KERSHAW, F.I.C.

IN many of the large power stations which have been erected recently in this country and abroad, the equipment of testing instruments has been very complete. In the author's opinion, it would be wise to increase rather than to diminish the number of these instruments, for the cost of providing them is but a very minor item in the total outlay upon the plant, and in most cases the savings effected will pay off the cost of equipment in a very short space of time. The provision of a complete set of indicating instruments for each boiler and of recording instruments for each group of boilers, is the ideal that should be aimed at; and one or more men specially trained for this work should be placed in charge of these instruments, and given full control of the records, in all large steam-raising plants.

It must be remembered, however, that the collection of a large number of graphs and test results alone will do nothing to increase the efficiency of the plant; and that the intelligent study of them and the co-operation of the boiler-house staff in the application of the information they convey is required

before the maximum efficiency of the plant can be attained.

The co-operation of boiler-house engineers and stokers in these records of boiler-house performance can best be secured by awakening their interest in the attainment and maintenance of good results, and in some of the larger English and American power stations it is now customary as a preliminary to the introduction of a bonus system of payment, to instruct the boiler-house staff in the mechanism and purpose of the various test instruments, with a view to obtaining a more willing and intelligent support in their use. In America, in fact, the training of boiler-house engineers and stokers is now recognised as one of the most important departments of efficient boiler-house management. Intelligent young fellows suited for the work are singled out early for this instruction, and are put through a special course of theoretical and practical training before they are promoted to the status of a fully qualified boiler fireman. This is the right attitude to adopt towards the work.

TABLE 1.—*Boiler-house Shift Log Sheet for Day Ending .....of..... 19.....*

Time.	Steam.			No. 1 boiler.							
	Pressure.	Sat. temp.	Super-heat.	Feed water temperatures.		Flue gases temperatures.		CO_2.	Draught.		
				Inlet.	Outlet.	Econ. inlet.	Econ. outlet.		Grate.	Econ. inlet.	Econ. outlet.
		Deg. Fah.	Deg. Fah.	Deg. Fah.	Deg. Fah.						
1..											
2..											
3..											
4..											
5..											
6..											
7..											
8..											
Total											
Average ..											

BONUS SYSTEMS IN THE BOILER-HOUSE.

As the writer has more than once pointed out in the past, the efficient and economical conversion of the latent heat energy stored in coal into the latent energy of high-pressure steam is a highly technical operation, involving a high degree of knowledge and intelligence on the part of the men who have charge of it, and the greatest mistake of the past has been to think that any man of good physique who could handle a shovel was fit to have control of boiler fires. Many millions of tons of coal have been wasted in England and America as a result of this fallacy.

Bonus systems of boiler control have therefore much to recommend them, but they are by no means in general use, and it is noteworthy that they have passed through the same phases of favour and disfavour as the automatic CO_2 testing apparatus, upon the results of which they were often based. Originally hailed with a chorus of approval, they were put into force by many engineers, especially in the larger electric power stations; but after a few months' trial the disillusionment produced by high CO_2 tests, in conjunction with still higher coal consumptions per unit generated, caused their disappearance, and, what was more serious, the discrediting of the whole system of tests and bonus rewards.

As a practical engineer recently said to the writer, the chief qualification of many firemen seemed to be their ability to produce high CO_2 tests with a remarkably low output of steam, and it was soon recognised that the CO_2 test alone was no criterion of the efficient operation of the boiler plant.

TABLE 1A.—*Coal Consumed.*

Shift.	No. 1 boiler.					
	No. 1 grate.		No. 2 grate.		No. 3 grate.	
	Reading.	Cwt.	Reading.	Cwt.	Reading.	Cwt.
A						
B						
C						
D						
Total						
Riddlings						
Net						

The next attempt to operate a bonus scheme was based upon the relation between the fuel consumed and pounds of water evaporated. This, in its turn, was relegated to the scrap heap of discredited systems of control, because firemen who possessed more ingenuity than honesty used the blow-off cock of the boilers as a means of increasing their pecuniary rewards.

To-day, many engineers of large stations are working them without any system of bonus payment to the firemen, simply because of these past failures, which were due to the non-recognition of the frailties of human nature, and of the fact that if there are two ways of achieving the same result the lazy members of society will always select the one that is least troublesome to themselves.

TABLE 2.—*Boiler Hours.*

	No. 1 boiler.	No. 2 boiler.	No. 3 boiler.
Steaming			
Stand by			
Without fires			
Total steaming to-day			
Brought forward ..			
Carried forward ..			
Hours since last cleaned			

Hours Run by Feed Pump.

	No. 1 pump.	No. 2 pump.	No. 3 pump.
On load			
Stand by			
Total to-day			
Brought forward ..			
Carried forward ..			

Riddlings.

Shift.	No. 1 boiler.	No. 2 boiler.	No. 3 boiler.
A			
B			
C			
D			
Total riddlings ..			

Coal Analysis.

Analysis.	A.	B.	C.	D.	Average.
Moisture					
Calorific value ..					
Ash					
Carbon in ashes					

With modern testing equipment and intelligent supervision, however, it is quite possible to devise systems of control and of bonus payment for boiler firemen and engineers which are quite fair in operation, and do not lend themselves to manipulation or "dodging" by even the laziest and most "workshy" of boiler firemen.

The bonus systems described below are practical schemes now in actual use. Schemes of this kind, when rightly operated, lead to great keenness and rivalry amongst the groups of men whose duty it is

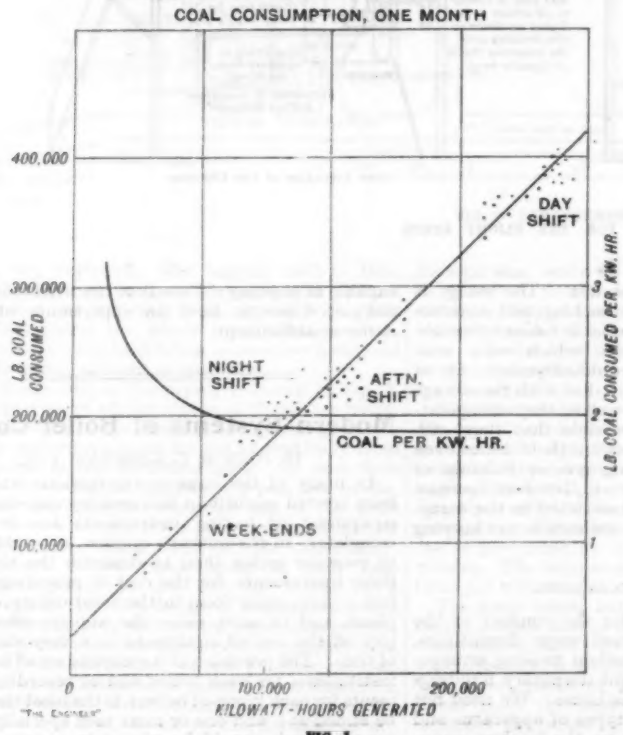


FIG. 1

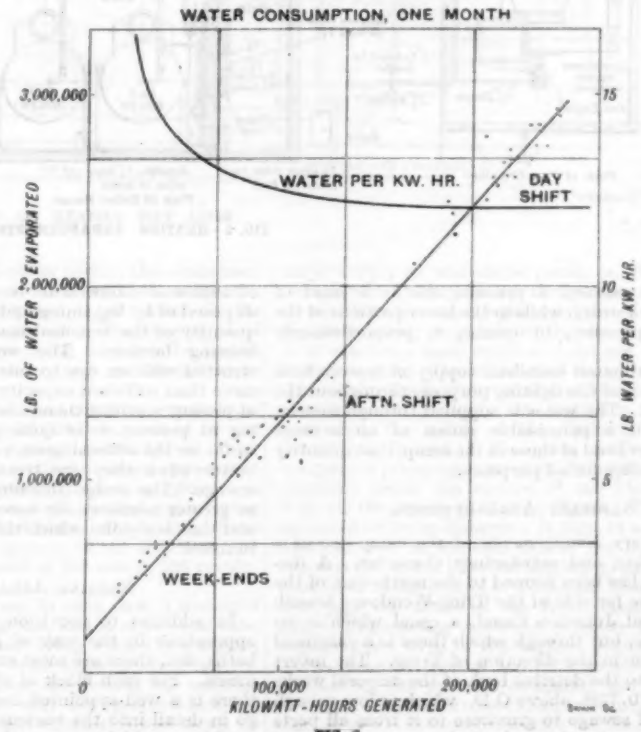


FIG. 2

to run the boilers, and therefore promote more efficient operation of the plant.

Two different methods may be employed for calculation of the bonus:—(1) The efficiency of the plant as obtained from the actual records of water and fuel used and steam produced; or (2) the efficiency as determined from a heat balance. In works where a complete system of testing instruments is provided, where the coal used is regularly sampled and tested, and a full record is obtained of the operation of each group of boilers, both methods of determining the the efficiency can be utilised, and the one can then be used as a check on the other.

Tables 1, 1A and 2 show the shift log sheets now in use at one of the most efficient electric power plants in this country, which under normal working conditions, is 8.7 lb. of water, from and at 212 deg. Fah.; and the overall efficiency of the plant, including economiser and superheater, lies between 75 and 80 per cent.

Each boiler is provided with its own separate control board, carrying the instruments provided for testing purposes; these include a steam flow meter; a CO_2 indicator; draught gauges of the simple U-tube type; and thermometers showing the temperature of the superheated steam, of the flue gases entering and leaving the economisers, and of the feed water at the inlet and outlet of the economisers.

The coal consumption is checked by automatic Avery weighing machines attached to the top of each chute to the feed hopper of each boiler; and the fuel used is sampled and tested regularly for calorific value, ash and moisture. The readings of all these instruments are taken half hourly, and are entered on the log sheet of the particular boiler to which they are attached. By aid of the data recorded on these sheets, it is possible to calculate the efficiency of any boiler or group of boilers, not only for each shift, but also for each 24-hour period. In order to obtain results that may be compared with those obtained in other stations, the pounds of water evaporated are finally worked out on a heat-unit basis.

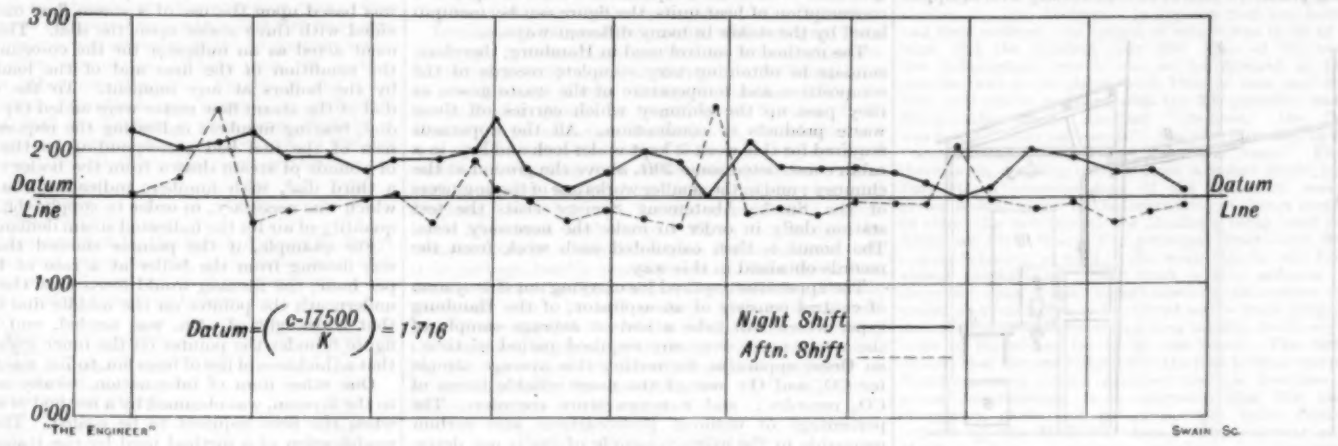


FIG 3

The system of control adopted at Dalmarnock is that formulated by Mr. R. H. Parsons. It was fully described by J. Bruce, in a paper read before the West of Scotland Branch of the Association of Mining Electrical Engineers in Glasgow, in November of last year. From that paper the following account is drawn.

The method is based upon the construction of charts which show the standard coal and water consumption of the plant at different outputs, and the comparison of these standards with the results obtained for any working shift or period of time.

In putting this system into operation, charts are first drawn up in which the coal consumption and total water evaporated are plotted against the corresponding power outputs, over a considerable period of time. The points obtained will be found to lie about a straight line, which represents the average performance of the station, over the period for which the observations had been made. The equations obtained from an analysis of these lines provide information of great importance to the efficient operating of the plant.

Figs. 1 and 2 are typical charts showing respectively, the coal consumption and the pound of water evaporated on a base of kilowatt hours generated. The range of output dealt with is seen immediately from these two figures.

From Fig. 1 the following equation is deduced:—

$$(1) \quad C = 20{,}000 + 1.716\,K,$$

where C = pounds of coal consumed per shift,
and K = electrical output in kilowatt hours per shift,
and the curve shown on this diagram represents the pounds of coal per kilowatt hour.

The principal deduction from the equation given above is that the "no load" coal consumption is 20,000 lb. of coal per shift; while the minimum coal consumption is approximately 1.8 lb per kilowatt hour.

Fig. 2 deals in a similar way with the relationship between the water evaporated and the electrical output, and the equation deduced from the line is

$$(2) \quad W = 100{,}000 + 11{,}535\,K.$$

From this it is seen that the "no load" steam consumption is approximately 100,000 lb. per shift, and that the minimum water consumption is 12 lb. per kilowatt hour.

If it be desired to bring more clearly to the operating engineer's attention any progressive increase or decrease of station efficiency, a further graph of simple construction may be used. Referring again to equation (1), it is seen that if there were no constant term, the coal consumption would be 1.716 lb. per kilowatt hour for all outputs. Therefore, when the operating statistics come in at the end of a shift, if the engineer first subtracts this constant term 20,000 lb. from the actual fuel consumption, and then divides the remainder by the electrical output, he will, if the standard of efficiency has been maintained, get as quotient the value 1.716.

An example of such a chart is shown in Fig. 3. A heavy straight datum line is drawn along the value 1.716, and the operating results are plotted above or below, as the case may be. A similar method may be employed to obtain a continuous graphic record of the water consumption rate of the station.

In applying the information obtained by this system of control to the calculation of the bonus, the actual performance of the station when operated by any particular shift or group of men is compared with the standard of fuel or water consumption for the electrical output obtained, and the wages of the men concerned are then increased by the same percentage as the standard has been exceeded.

It is claimed by Mr. R. H. Parsons, the originator of this method of calculating bonus payments, that while providing a useful and appreciated bonus for such savings as are reasonably likely to be made, the bonus will not become absurdly excessive, if unexpected economies are brought about. A saving of 50 per cent. of the fuel would only increase the wages of the firemen to "time and a-half," and hence there need be no hesitation in establishing a bonus on the plan advocated in any plant, no matter how low the existing standard of operation may be. Moreover, the management is quite safe in giving a pledge to the men that, once established, it shall never be modified or withdrawn without their consent. This is a very important consideration when inducing the men to endeavour whole-heartedly to improve the operating results.

The fact that the standards are not mere theoretical ideals of efficiency, impossible to attain in practice, is a very important point. Being based entirely on the average of actual performances, they are manifestly fair and easy to improve upon. To enable the workmen to understand the scheme and to know how their bonuses are computed, however, it is advisable to tabulate sets of figures, giving the standards of coal and water consumption per kilowatt hour for different outputs, and the coal required for different quantities of water evaporated.

As a check to the temptation of the less scrupulous firemen to "help things along a bit," by excessive blowing down of boilers so as to get fictitious evaporation figures, the engineers' bonus can be based on the water consumption per kilowatt hour. Such a trick will then adversely affect their interest, and they can be trusted to see that no excessive blowing down occurs. The evaporation figures may also be taken from the readings of the integrating steam meters attached to the boilers, and all inducement to blow the boilers down unnecessarily will thus be removed.

Bonus Scheme in Operation at the Potteries of Messrs. Doulton and Co.

The scheme of bonus payments described below has been in operation at the well-known pottery works of Messrs. Doulton and Co. at Lambeth and at Dudley, since August, 1921, and it is stated by W. Thomason, the chief chemist at their works, to have increased the efficiency of the boilers by 28 per cent. These boilers are hand fired, and are worked with balanced draught. The system of control is based upon the measurement of the heat losses in the waste gases and in the cinders and ashes, and upon the payment of a bonus when the total of these two losses does not exceed 28 per cent.

The actual losses from these causes have been for a period of 66 weeks 13.5 per cent. in flue gases, and 2.32 per cent. in unburnt fuel, which means an efficiency of about 74 per cent. allowing for other losses which are unavoidable. The exit gas losses are readily arrived at from standard tables based upon the ultimate analysis of the fuel used, and upon the most exact specific heats of the gases in question, and they are correct for practically all bituminous coal,

ditions is obtaining an efficiency of 80 per cent. There is no doubt that the introduction of a similar system of record keeping, in conjunction with a bonus system, in plants now working at a much lower average efficiency would result in very large economies of fuel.

The Manchester Corporation Electricity Station, Stuart-street.

The bonus scheme originally introduced at this station was based upon the coal consumption per unit generated. When this was reduced below a certain predetermined limit, the engineers, foremen stokers, stokers and trimmers all received an addition of 10 per cent. to their wages. The standard of coal consumption was varied from time to time, according to the class of fuel used and to the previous year's average of the station, and it was partly as a result of this change in the basis that the system was finally discarded. When the system was first introduced the standard was 5 lb. per kilowatt-hour. As a result of the improvements in the plant and in the skill of the boiler-house staff, the figure was reduced in successive steps to 3 lb. per unit generated, at which it stood when the scheme was withdrawn.

The plan now in operation at this station is based on the average efficiency of the steam generating plant, as calculated from the data obtained over the whole of one month. The bonus is paid to all the boiler-house engineers, both operating and repairing, and to all technical assistants, at the rate of £1 for every 1 per cent., or fraction thereof, over the standard efficiency of 70 per cent.; while the leading stokers receive half this amount. The scheme is reported by the chief engineer to work well, and to lead to the exercise of greater care and diligence in the performance of their duties by all the boiler-house staff.

The Dalmarnock Super Power Station of the Glasgow Corporation.

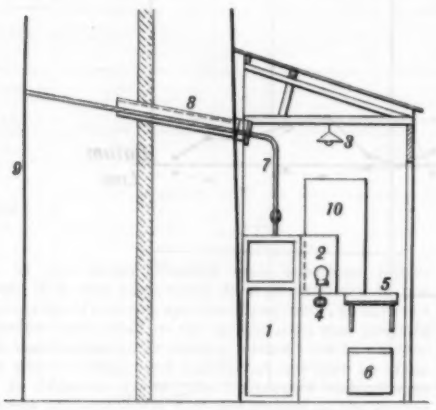
The Dalmarnock super power station is of interest to engineers, because the Parsons' system of control practised there is one that lends itself quite easily to the introduction of a bonus system of payment; and it is probable that the complete adoption of Parsons' scheme will follow at an early date.

The boilers of this station, the present capacity of which is 100,000 kilowatts and the ultimate capacity 200,000 kilowatts, are of the Babcock and Wilcox marine type, with a rated capacity of 50,000 lb. steam per hour, when operated at a pressure of 275 lb. per square inch. The heating surface is 6948 square feet for the boiler; 2452 square feet for the superheater; and 5255 square feet for the economiser, which is situated directly above each boiler; a total of 14,655 square feet of heating surface. Three chain grate stokers with a total grate area of 273 square feet, are installed under each boiler. For normal requirements the boilers are operated with induced draught, and when pressed for steam under forced draught; the maximum output under the latter conditions being 62,500 lb. The coal used is from the Lanarkshire coalfield, and contains 15 per cent. ash; its average calorific value is 10,500 B.Th.U. The evaporative efficiency of this coal, under normal

with a possible limit of error of 1.5 per cent.—plus or minus. The figures are the percentage losses or the gross calorific value of the fuel. Where coke is used a modified table can be obtained if thought desirable.

It is evident that a bonus payment depending on the CO_2 exit temperature and unburnt fuel withdrawn with the ashes would operate unfairly in the event of a works not operating at full capacity, since on light load the boilermen have the chance of reaching a higher efficiency than where the load was heavier, and at a time when the employer might be less able to pay the bonus. For that reason the full bonus is only payable when the works are running at full capacity, and falls with the output, but never to lower than 50 per cent.

For operation of this system of control the steam-raising plants at Lambeth and Dudley are equipped



1. Aspirator. 6. Electric Radiator.
2. Orsat Apparatus. 7. Gas Connection to Chimney.
3. } Electric Lamps for 8. Protecting Tube.
4. } illumination purposes. 9. Centre of Chimney.
5. Writing Table. 10. Window.

"THE ENGINEER" SWAIN SC.

FIG. 4

with CO_2 recorders of the Simmance and Abady type, and with temperature recorders of the Cambridge and Paul type. These instruments are placed on a convenient wall and within easy view of the stoker or stokers. The men readily appreciate that their object is to keep the CO_2 as high as possible and the exit temperature as low as possible, consistent with the general level of steam pressure being maintained at the working pressure of the factory. They rapidly learn, under tuition, that there are other ways of holding the head of steam in addition to the one usually adopted, of raising the damper and incidentally increasing the exit temperature of the waste gases and reducing their CO_2 contents, both of which tell against their bonus.

The instruments are capable of being checked at will by direct reading on an Orsat apparatus for the CO_2, and by a direct reading of the temperature by means of a suitable armoured mercury and glass thermometer. This checking should be done with some regularity, particularly in the case of the temperature recorders, which tend to read lower than the truth after continuous service in the boiler flues.

Since August, 1921, the heat unit losses in exit gases have been only 13.5 per cent., or a difference of some 16.5 per cent., to which must be added the reduced heat losses from unburnt fuel, which is now 2.32 per cent. Assuming that there was in both cases a further and unavoidable loss of 10 per cent., we have a present efficiency of 74 per cent., compared with a previous efficiency of about 55 per cent. This shows an economy of some 26 per cent., and compares sufficiently well with the economy observable from the fuel weighings.

A liberal bonus is an essential part of the scheme, especially when operating with low-grade fuels; and at Messrs. Doulton's works the bonus amounts under the most favourable conditions to between 25 per and 30 per cent. of the stokers' ordinary daily rate of pay. Further details of this method of control will be found in the February, 1923 issue of the *Fuel Economy Review*.

Use of Heat-unit Standard as Basis of the Bonus System.

Mr. I. V. Robinson, in a paper read before the Incorporated Municipal Electrical Association at Bradford, in 1920, described a method of calculating the overall thermal efficiency of power plants which might be used as basis of a bonus scheme of payment. In this paper he stated that it was possible to construct a Willans line connecting the fuel used and units generated per day; and that with the aid of this line it was possible to calculate the heat-units required to generate one unit of electric power, for all possible load factors experienced during the 24 hours. In a modern power station, with a daily load factor of 40 to 50 per cent., a figure of 20,000 B.Th.U. per unit generated might be considered the standard for comparison.

A German Scheme of Bonus Payments.

The engineers of the Hamburg Smoke Abatement Society have devoted considerable attention in the past to the subject of a bonus system of control for the large number of small steam plants in Hamburg under their management; and the method which they have now adopted as the most reliable, is based upon the calculation of the efficiency of the plant from determination of the heat losses with the chimney gases, and not upon the fuel—or heat-units—consumed for the generation per kilowatt hour.

The reasons given for considering this method superior to those based on the water evaporated or coal used are that coal varies greatly in calorific value, and that even if the evaporation be based upon the consumption of heat units, the figure can be manipulated by the stoker in many different ways.

The method of control used in Hamburg, therefore, consists in obtaining very complete records of the composition and temperature of the waste gases, as they pass up the chimney which carries off these waste products of combustion. All the apparatus required for this work is kept under lock and key, in a cabin constructed some 20ft. above the ground at the chimney; and in the smaller works one of the engineers of the Smoke Abatement Society visits the test station daily in order to make the necessary tests. The bonus is then calculated each week from the records obtained in this way.

The apparatus required for carrying out this system of control consists of an aspirator, of the Hamburg type, which will take a correct average sample of the waste gases over any required period of time; an Orsat apparatus for testing this average sample for CO_2 and O; one of the more reliable forms of CO_2 recorder; and a temperature recorder. The percentage of unburnt hydrocarbons and carbon monoxide in the average sample of gas is not determined directly, but is ascertained by the empirical method described by the writer in the handbooks referred to below.*

Fig. 4 shows a sectional elevation of a test cabin recommended by the Hamburg Society, with the position of the various testing instruments. From 15 min. to 30 min. are required daily by the engineer who passes round to make the tests and fill up the log sheet for the test of each particular plant.

The bonus payment is based upon all gains on the average efficiency, as determined by preliminary tests of the plant run by a skilled fireman at different loads. A diagram can then be constructed showing the percentage of premium which is to be paid for the different percentages of heat present in the chimney gases. Fig. 5 shows such a diagram for three

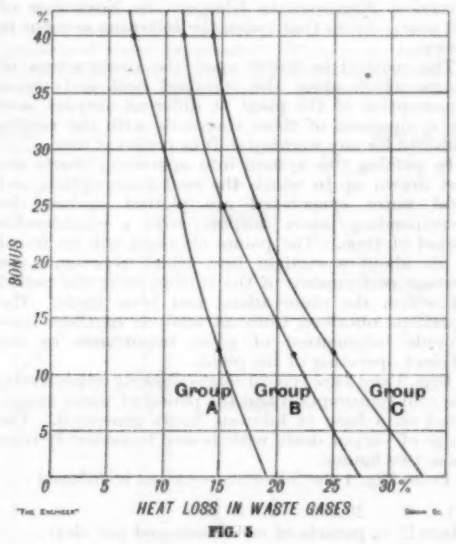


FIG. 5

different steam-raising plants in Germany—the designs of which are different, the normal efficiencies, therefore, showing wide variations.

As an example of the effect of the bonus system upon the working of a plant, tests are given by Herr Nies showing the heat loss in the chimney gases during a period of five months in 1921. Starting with a percentage of 22 per cent., the loss was reduced to 15 per cent. in May, and to 10 per cent. in June, and it remained at the latter figure for the remainder of the period. In another case the efficiency of the plant was improved by 10 per cent. in a very short period of time after this system of control had been introduced.

An American Method of Control.

W. N. Polakov, in a paper read before the American Society of Mechanical Engineers just before the war, described a bonus system of control which he had put into operation at the central generating station of the Penn Electric Light and Power Company at Warrior Ridge, with very good results.

The problem there was two-fold. First, to determine the conditions which would result in a maximum operating economy; and, secondly, to determine the factors which would secure the permanent attainment of these best conditions. The result of the system was a steady improvement in the working of the station, and, ultimately, an efficiency of 73 per cent. was obtained.

In order to determine the amount of the bonus, maximum and minimum limits were established, and when the bonus actually reached either of these limits, it was found to lose its usefulness. In the average boiler-house the savings possible are about 25 per cent., while the firemen's pay only totals from 10 to 15 per cent. of the coal bill; and it is evident, therefore, that in most plants there is considerable latitude for adjustment of the bonus.

The method of control adopted at Warrior Ridge was based upon the use of a steam flow meter, provided with three scales upon the dial. This instrument acted as an indicator for the co-ordination of the condition of the fires and of the load carried by the boilers at any moment. To the ordinary dial of the steam flow meter were added (1) an inner dial, bearing numbers indicating the required thickness of the fuel bed corresponding to the number of pounds of steam drawn from the boiler; and (2) a third dial, with numbers indicating the draught which was necessary, in order to supply the required quantity of air for the indicated steam demand.

For example, if the pointer showed that steam was flowing from the boiler at a rate of 14,000 lb. per hour, the fireman would learn that the figure 4 underneath the pointer on the middle dial indicated that a draught of .4in. was needed, and that the figure 6 under the pointer on the inner scale showed that a thickness of fire of from 6in. to 7in. was required.

One other item of information, vitally important to the fireman, was obtained by a method of signalling when the fires required to be coaled. This was a modification of a method used by the Italian Navy, and was regulated by a clockwork mechanism connected to the steam flow meter. For use in a boiler-house, where a number of batteries are fired independently, the Italian Navy method is modified by arranging that the counter of the feed-water meter shall ring a bell every time a certain number of thousands of pounds of water are fed to the boilers.

In order to reduce the time required for obtaining the efficiency of the boilers under this system of control, a rapid method of calculation was devised, and used also, for obtaining a complete record of each fireman's work. The following data were required:—(1) The weight of coal used, based upon the store-issue tickets and the coal-passer's reports, compiled every 8 hours; (2) the heat value of the fuel determined by bomb calorimeter, and the average value of the coal in B.Th.U. passed through each coal pocket; (3) the amount of water fed to each boiler for each 8-hour period—banked boilers being fed separately; (4) the temperature of the feed water; (5) the steam pressure; (6) the degrees of superheat.

These data were handed to the station clerk, who, by aid of a special slide-rule calculated the factor of evaporation, on the basis of absolute boiler pressure and temperature of the feed water and of the superheated steam. Then, by aid of a power plant log calculator, he determined: (1) The actual evaporation ratio; (2) the factor of evaporation; (3) the equivalent evaporation; (4) the efficiency of steam generation, and (5) the cost of fuel per 1000 lb. of steam, all of these results being calculated for each shift and each man separately. The results of this calculation were then entered up on the daily power plant report form, and the whole procedure did not take more than 18 min. of the clerk's time.

A record of the work of each fireman was thus obtained, and the number of men falling short of the task set before them was steadily reduced.

Steel Development in South Africa.

(From a South African Correspondent.)

THE development of the iron and steel industry within the Union of South Africa, and the considerable impetus which it has received during the past twelve months owing to the decision of Parliament to grant substantial bounties, coupled with the fact that a most important amalgamation of interests is now practically completed, all combine to make this an opportune time to give a somewhat detailed description of the stage which the industry has now reached.

But, first of all, one may just refer to the question of raw materials. The quantity of coal contained within the Union is estimated at 56,200 million tons, the quality ranging from anthracitic to sub-bituminous coal, brown coals, and lignites. In the Transvaal, where the main iron and steel industry is situated, it is estimated that the coal resources amount to 36,000 million tons. As a whole, Transvaal coals are high in ash and sulphur, but considerable improvement of them is often effected by suitable washing. Independent of that, however, investigation and experiments have shown that there are many millions of tons of coal which will make excellent coke, and that Natal coal exists in even larger quantities and

* "Smoke Prevention and Fuel Economy," "Fuel, Water, and Gas Analysis," by J. B. C. Kershaw, F.I.C. Constable and Co.

of the most suitable description. In fact, many thousands of tons of coke are already being made at Newcastle.

IRON ORE DEPOSITS.

The iron ore deposits of the Union have been fairly well proved already. On the Pretoria town lands alone, many millions of excellent ore are cheaply available. Sulphur in the ore is very low, but phosphorus is too high for the acid steel-making processes, so that basic open-hearth would have to be used. In the Eastern Transvaal many hundred million tons are estimated to be easily obtainable. In addition, there are enormous deposits which are at present considered to be commercially valueless on account of the refractory character of the ore, owing to the high percentage of titanium, which is usually between 2 and 19 per cent., with iron from 45 to 60 per cent.

There is an abundance of manganese ores. One occurrence is estimated to contain 500,000 tons, and six others inspected were estimated to contain somewhat smaller quantities. There are, of course, numerous other occurrences. Fluxes in the form of magnesian limestone are present in unlimited quantities, and at Taungs a very large deposit of non-magnesian limestone, estimated at 7,000,000 tons, occurs. Two analyses are given of this flux :—

Silica and insoluble	.28	.18
Calcium carbonate	98.00	95.30
Magnesium carbonate	.48	.25

From data supplied by the South African Railways the mines, and other sources, it is estimated that the present annual iron and steel requirements of the Union are approximately as follows :—

	Tons.
Rails, crossings, &c., railway	65,000
Rails, mines	12,500
Angles and channels	5,000
Bar, bolt and rod	21,000
Girders, beams and columns	8,000
Plate and sheet	10,000
Bolts, nuts and washers	2,500
Fencing standards	25,000
Drill steel	6,000
Shoes and dies	7,500
Steel castings	2,500

A total of 165,000 tons, to which must be added 10,000 tons of pig iron, and in all probability considerable outside demands from Colonies bordering upon the Union.

In order to make clear the reason for the considerable amalgamation which is on the point of conclusion, it must be explained that Parliament at the last session but one, consented to grant a bounty of 15s. per ton on every ton of pig iron made from iron ore mined in the Union, and 15s. per ton for all iron and steel manufactured from that pig iron. It was stipulated, however, that the bounty would not be paid unless the company claiming it had made 50,000 tons of pig iron or 50,000 tons of iron or steel from South African pig iron in each year for which a claim was made.

NEWCASTLE BLAST-FURNACE.

At the time this Bounty Act was passed, the Newcastle Iron and Steel Company, Limited, had begun the erection of a blast-furnace at Newcastle, in Natal. The furnace was to be 14ft. by 65ft., provided with a blowing engine with air cylinders, 70in. by 60in., supplied with steam from 1200 horse-power boilers, which could be fired with coal dust when gas was not available. The output was expected to be about 100 to 120 tons per day, and the manufacture of cast iron pipes and other iron and steel castings was contemplated. On the passing of the Act, the design was altered to bring the output up to the quantity required—50,000 tons a year. This blast-furnace was completed, and is to-day the only one worthy of the name in South Africa. The company has, however, no plant for utilising the pig iron. On the other hand, the Union Steel Corporation, whose works are at Vereeniging, Transvaal, and the South African Iron and Steel Corporation, Pretoria, Transvaal, have no blast-furnaces, and it is their mutual needs, the one complementary to the other, which has now brought about the amalgamation of these three concerns.

The South African Iron and Steel Corporation's plant is negligible at present, and it will be sufficient, therefore, to give a description of the Union Steel Corporation's Vereeniging steel works, by far the largest and best equipped in the country at present, though the Dunswart works bids fair to become a big rival later.

The Union Company was formed in 1912 as a result of the Government offering to public tender a huge accumulation of scrap iron and steel lying at Pretoria and other railway depôts, a condition being that the successful tenderer should erect a plant for the production of steel from scrap, and allocate a certain portion of profits made to experimental work on native ores, with the object of proving their suitability for the production of iron.

VEREENIGING WORKS.

These works stand on the banks of the Vaal River, Vereeniging, and are connected by sidings with the main railway line, about three-quarters of a mile away. The plant began operations in 1913, and with two basic open-hearth furnaces, of respectively 10 tons and 20 tons capacity fired by gas from Witbank coal. The plant was capable of turning out a variety of products, namely, light sections from ¼in. rod up to 30 lb. rails, and steel castings were also made up to 5 and 8 tons. The employees numbered 117 white men, skilled, and 253 coloured labourers.

To-day the works occupies a total area of approximately 50 acres, and employs 800 men. The large electric power station of the Victoria Falls and Transvaal Power Company, Limited, is situated within a few hundred yards of the works, and from this source the Corporation obtains the electric power necessary for the running of the whole plant. Adjacent to the steel works are the works of the Vereeniging Brick and Tile Company, Limited, by whom the fire-clay, silicia and magnesito bricks required for the steel furnaces are manufactured, while the coal necessary for the gas-producing plants is supplied from the collieries of the Vereeniging Estates, Limited, which are situated in the district.

Increase of business compelled the company two years ago to face a very great enlargement of manufacturing power, which included the building of a 25-ton Siemens-Martin furnace, together with its gas-producing plant. A large electric furnace of the Heroult type was also erected, and, in addition, a new 22in. finishing mill. This mill is equipped with a mechanical live roller conveyor, hot banks and banks for material awaiting straightening and finishing. Soaking pits for the reheating of ingots have also been laid down. There is, it may be mentioned, a 30-ton ladle to teem the metal from, but it is perhaps hardly necessary to go into the minor details or describe the steel foundry, 600-ton hydraulic press, &c. &c. It will perhaps give a very good idea of the capabilities of the works if it is said that the contract, amounting to many thousands of tons, for the necessary structural material required in connection with the electrification of the Glencoe-Maritzburg line is well in hand.

WORK BEING UNDERTAKEN.

The sections undertaken by the Corporation comprise :—Tube mill bars, grizzley bars, rails from 16 lb. to 45 lb. per yard, and, if necessary, up to 60 lb. per yard; fish-plates to suit all sections of rails; angles, 1in. to 6in.; tees and channels—all of usual standard thicknesses. Flats, rounds and squares, steel castings up to 10 tons each, skip wheels and truck wheels of all kinds, reinforcing steel, shoes and dies. A contract for the mines of the Witwatersrand for 10,000 tons of shoes, dies, rails, tube mill bars and grizzley bars was entered into a while back. There is not space to deal with the physical tests for steel castings, certain special steels made, including a manganese alloy steel for tramway crossings, and crusher jaws, or to deal with the method of controlling the temperature of the annealing furnaces. A few remarks must be made with regard to the Heroult furnace.

The electric power for the Heroult furnace is supplied at 5000-volts A.C., and is stepped down to 90 and 75 volts through three 150 kilovolt-ampères water-cooled transformers, giving a ratio of 55 to 1 and 66 to 1. The current is then passed by means of copper bus-bars to three flexible conductors capable of carrying 4000 ampères, connected to the electrode holders which carry the graphite electrodes. The electrodes, which are 6in. diameter, held in position by water-jacketed holders, are separately operated by 5 horse-power 500-volt A.C. motors, through drum type controllers. The tilting of the furnace is done by 15 horse-power 500-volt A.C. motor, which is directly coupled to a worm gear connected by a revolving spindle to the furnace.

BIG NEW PROGRAMME.

Now that amalgamation has been effected the following programme is to be carried out. The erection of such plant at Vereeniging as will produce 17,500 tons of corrugated, galvanised and other sheets per annum, also a rod mill of a capacity of 20,000 tons per annum, with a wire mill and accessories for the production of 15,000 tons of wire per annum. These two plants will consume 40,000 tons of bars and billets, equal to 43,000 tons of steel ingots per annum, which will leave 17,000 tons of ingots for the 15in. and 12in. mills. The present melting plant at the works is to be extended as a temporary measure, and its capacity brought up to such a point that production of the blast-furnace at Newcastle can be absorbed. The additional capital required is estimated at £500,000, and is now being raised. A portion will go towards completing the equipment of the Newcastle blast-furnaces.

In conclusion, it may be recalled that the capacity of the Dunswart iron and steel works, in which an interest has been acquired by Messrs. Head, Wrightson and Co., is to be nearly doubled in the immediate future.

ROYAL INSTITUTION.—A general meeting of the members of the Royal Institution was held on Monday afternoon, the 4th inst., Sir James Crichton-Browne, Treasurer and Vice-President, in the chair. Lord Boston, Mrs. Goodbody, Colonel Lyons, Miss Emily Martin, Sir George Scott-Moncrieff, Mr. A. Cressy Morrison, Lord Riddell, Miss Robertson, Captain Edward Spencer-Churchill, the Hon. David Tennant, Mr. J. F. Thorpe, and Major W. S. Tucker were elected members.

SIXTY YEARS AGO.

IN our issue of February 5th, 1864, several interesting subjects are dealt with. It is reported, for instance, that "within the last day or two" active measures had been taken in proceeding with the portion of the Thames Embankment between Waterloo Bridge to the east end of Temple Gardens. The contract, it is explained, was being executed by Mr. Ritson, and the works are described as being difficult "in consequence of the necessity of not interfering in any way with Somerset House." It was understood that none of the houses in Norfolk-street, Arundel-street, or the Temple would be removed. Then, again, we read that the Admiralty had decided to try the experiment, that year, of building vessels plated with 4½in. iron, but of small tonnage. The Research, of 1250 tons, "coated from end to end with Warrior plates," had, it is stated, proved a great success. She drew only 14ft. of water, steamed 10½ knots, and had fought successfully against a gale which had driven a wooden sloop of similar size into harbour. It appears that ten ironclads had been ordered, the largest of which was to be of 4246 tons, and the smallest only 990. One of the vessels, the Bellerophon, which was to be finished in twelve months, was to be plated with 10in. of teak and 6in. of iron, and was to be fitted with ten 300-pounder, and two 600-pounder guns. Another "steamer," the Pallas, was being "built for speed." She was intended to carry "sixteen days' coal at 14 miles per hour." Finally, there is an amusing extract from a report made by the Port Royal correspondent of the *Baltimore American* giving a description of the operations of divers employed to clean the bottoms of the Monitors being used in the American Civil War. The principal diver—one Waters—was, it seems, so used to the work that he had become almost amphibious. "The work is very arduous. The diver sits upon a spar lashed athwart the bottom of the vessel, so arranged as to be moved as the work progresses, and, with a scraper fixed to a long handle, works on both sides of himself as far as he can reach. The mass of oysters that become attached to the iron hulls of one of the Monitors, even during summer here, is immense. By actual measurement it is estimated that 250 bushels of oysters, shells and sea-grass, were taken from the bottom of the Montauk alone. The captains of the Monitors have sometimes indulged in the novelty of a mess of oysters raised on the hulls of their own vessels." It is explained that "when a diver is below the surface he can instantly bring himself up again by closing momentarily the aperture in the helmet for the escape of air. His buoyancy is immediately increased, and he pops up like a cork and floats at will on the surface." The diver Waters was evidently a bit of a wag besides being a master of his business. "When he has a curious audience (he) will wave his scraper about as he 'bobs around' on the water with the air of a river god." Once he came up beside a boat from which a negro was selling water-melons, one of which he seized and sank below the surface again, the "gurgling air from the helmet mixing with his muffled laughter." The negro clutched his oars and fled, declaring that the Yankees had "brought river devils to aid them in making war."

BRITISH ENGINEERING STANDARDS ASSOCIATION.

THE British Engineering Standards Association has published four additional specifications for ships' fittings, of which the following gives brief particulars :—

No. 3006–1924 : *British Standard Specification for Stud Link Cables* (*Anchor Cables*).—This publication specifies the material and manufacture and the tolerances allowed on common links, enlarged links, end links and joining shackles, together with the minimum and maximum length over ten common links and minimum and maximum length over enlarged link, end link and shackle. The sizes of cables dealt with range from 3in. down to $^{7}/_{16}$in. in steps of sixteenths. The B.S. numbers represent 15-fathom lengths of cable, including the enlarged link, end link and joining shackle.

This specification has been drawn up with the co-operation of the Board of Trade, Lloyds and other Register Societies, as well as of the cable makers and makers of windlasses. The adoption of standard cables by shipowners will minimise the difficulty which has hitherto been met with, namely, the links of the cable not bedding into the lifters of the windlass. During its preparation, important tests were carried out with specially forged lengths of cable to obtain the necessary data required in order to be able to fix the greatest tolerances which could be allowed on the links, and yet allow them to pass over the lifters of the windlass without the risk of their jamming.

No. 3007–1923 : *British Standard Specification for End* (*or Bending*) *Shackles*.—This document covers bending shackles for attachment of cables to anchors. The standard sizes given are for use with cables of $^{7}/_{16}$in. to 3in. in diameter.

No. 3008–1923 : *British Standard Specification for Hand Screw* (*Aft*) *Steering Gear*.—This publication specifies only the chief dimensions, leaving the general design to the individuality of the manufacturer. The distance, however, from the centre of the rudder stock to the centre of the crosshead pins, which hold the connection-rods, and incidentally take the greater portion of the shock of the rudder, is specified, as is also the diameter of the screw threads, which are left and right-handed. The type of thread is also specified, but not the pitch, which alters according to individual requirements.

No. 3010–1923 : *British Standard Specification for Devil's Claws*.—This document fixes the standard for the principal dimensions and the material from which the fitting is to be made. As in all standards issued by the B.E.S.A. for ships' fittings, great care has been taken with regard to the factor of safety, and it will be seen in all the foregoing standard fittings that ample provision is made for this.

Copies of these publications may be obtained from the B.E.S.A., Publications Department, 28, Victoria-street, London, S.W. 1, price 1s. 2d. each post free.

Improvements in Suction Dredgers.

IN operating with a sand pump or suction dredger, the object in view is to dredge the solid material of the bottom, and the water which is pumped in order to do this is a vehicle only. It is obvious, therefore, that the higher the percentage of sand which can be carried in the water the more economical will the dredging operations be.

In the ordinary, plain, open-ended suction pipe, there is a great variation in the percentage of sand carried in the water; this varies from 4 or 5 per cent. to 50 or 60 per cent. of the water, by volume, and one of the difficulties in attempting to increase the percentage by forcing the end of the suction pipe further into the bottom is the obstruction to the entrance of water which results, with the usual violent vibrations so injurious to the machinery.

The device now described is intended to (*a*) increase the percentage of sand in the water pumped; (*b*) do away with the danger of starving the pump.

It consists of a modification of the jet dredger combined with the ordinary suction dredger. Up to the present, however, when jets are used for breaking up the material of the bottom, they are produced by an auxiliary pump carried on the deck of the dredger, and, therefore, the quantity of water delivered by the jets is comparatively small and quite insufficient to prevent starving of the sand pump when the end of the suction pipe becomes buried in the bottom. The extra machinery, piping and pump required are also costly. In the present apparatus the jets supply sufficient water for the sand pump, and are produced by the operation of the sand pump itself, and the device is an extremely simple one.

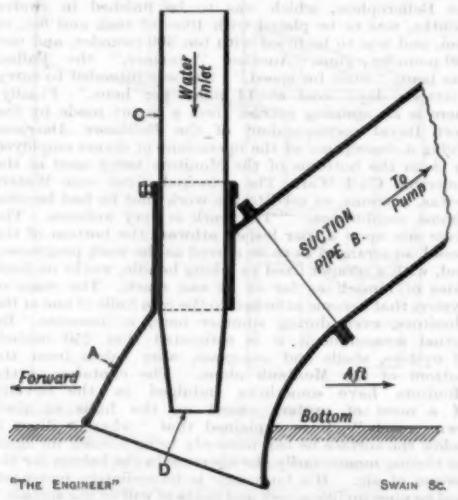


FIG. 1—IMPROVED NOZZLE FOR SUCTION DREDGERS

Referring to the accompanying drawing, Fig. 1, a mouthpiece A is provided for the suction pipe B having its opening directed at an angle to the suction pipe, so that in the dredging position it is nearly, but not quite, parallel to the bottom, the opening facing slightly forwards. Penetrating the back of this mouthpiece is a nozzle D, which terminates inside the mouthpiece and a little above its opening. The nozzle D is connected to, or continuous with, a pipe C, which projects into the water above the mouthpiece and serves to admit water to the nozzle. This is the whole apparatus, and its operation is as follows:—

When the suction pipe is lowered to the bottom, so that the opening of the mouthpiece is closed, and the sand pump started, a jet of water is produced inside the mouthpiece and directed against the bottom. This is produced by the suction of the sand pump itself and causes the mouthpiece to sink in the sand, a condition which would normally be liable to produce starving of the pump and has, therefore, to be watched very carefully; but in this case the tube C, projecting upwards, admits the necessary water for the sand pump and supplies it in the form of a powerful jet which, striking the bottom, breaks up and suspends the material in the water; thus dredging can be carried on with higher efficiency and without danger of starving the pump.

The mouthpiece, with its nozzle, can be made either as a single casting or built up from light steel plating and the usual grating—not shown in the drawing—can be fixed. This appliance adds little or no complication to existing apparatus and can, if desired, be easily put out of action by closing the pipe C. It is also evidently advantageous to direct the ingoing water so that it will impinge upon the bottom more or less normally rather than, as in the ordinary suction pipe, flow in around the mouthpiece tangentially to the bottom.

Another application of the same principle is to pumping out of the loaded hopper of a dredger or barge. The structural modifications required to permit a suction dredger to discharge the sand from her own hopper are usually considerable, whereas, by the application of the principle now described, there is little structural alteration required as compared with the ordinary hopper.

To apply the principle a suction pipe is fixed in the air chambers at each side of the hopper, running parallel to and close beside it. These suction pipes connect with the main sand pump by means of a valve, which can be used to put them in or out of action. The connection to the hopper is by means of a series of openings at the bottom of the side walls of the hopper, and the detail of one such connection is shown diagrammatically in Fig. 2. The difficulty in pumping sand from a hopper lies in the fact that a sufficient supply of water must be provided to suspend the sand, and the method which may be adopted for providing such water determines, to a great extent, the efficiency of the arrangement. By the method now described, the percentage of sand in the mixture of sand and water can be kept very high, and thereby the time of discharge reduced to a minimum.

Referring to Fig. 2, it will be seen that at each connection between the hopper and the suction pipe there is also provided a connection to the bottom of the vessel for the admission of water, and this water is caused to impinge against the sand in the hopper in the form of a jet formed by the action of the sand pump itself. The jet impinges in the immediate vicinity of the entrance from the hopper to the suction pipe, and thus the disturbed and suspended sand is carried into the suction pipe with the stream of water.

Each opening on the side of the hopper is provided with a sliding valve, which permits that particular opening to be put in or out of action and, by means of a stop on the face of the valve when it is pushed home, the opening for the jet is also closed. As the valve is being pushed home the entrance to the hopper is closed before the mouth of the jet, so that a stage is reached in closing the valve when nothing but water is drawn into the suction pipe. This is necessary in order to wash away the sand which may have been deposited. The valves are operated by means of hand wheels and screws on the gangway beside the hopper, and this material may be pumped from any part of the hopper. Each connection from suction pipe to hopper may be in the form of a casting and serve to support the suction pipe in the air chambers, and thus to equip a dredger for pumping from her own hopper by this method is a comparatively inexpensive matter. Both these improvements, which have already been tested, are the invention of Dr. John S. Owens, of 47, Victoria-street.

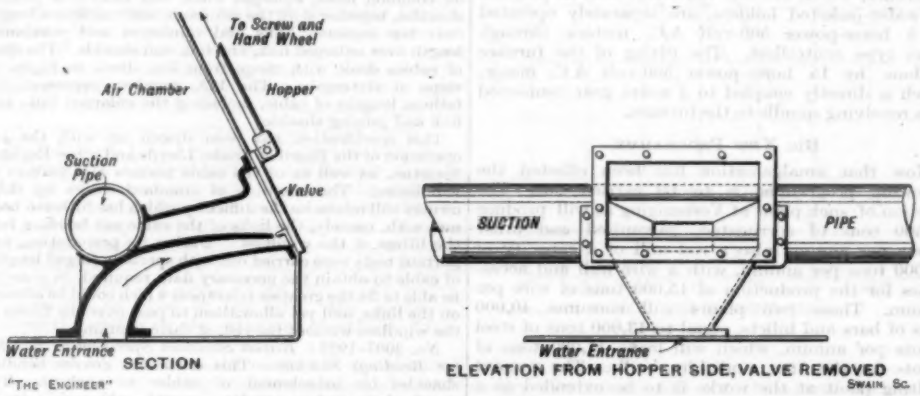


FIG. 2—APPLICATION OF THE SYSTEM TO A HOPPER

Letters to the Editor.

(We do not hold ourselves responsible for the opinions of our correspondents.)

POWDERED FUEL.

SIR,—There are two equally conclusive ways of showing that the Lakeside test figures are wrong. In my letter of January 4th I adopted the more direct way. I showed that the Parsons evaporation line drawn through the plotted test figures cuts the base of the diagram, thus indicating that the radiation and other constant losses are negative! No engineer would require stronger evidence that some error must have been made in measuring the pulverised coal consumed or the water evaporated.

Mr. Swindin draws another line which does not cut the base of the diagram, and claims this to be the true evaporation line. If his claim is correct, the fact that the line does not agree with the test figures again shows the latter to be wrong. The same conclusion—namely, that the figures in Mr. Brownlie's table are not worthy of confidence—is, therefore, arrived at by either method of reasoning.

I would ask those interested in the matter to take the five tests given in Mr. Brownlie's paper and plot for each test the coal consumed in 8 hours against the water evaporated during the same period. If they will then draw a straight line through the points so obtained, they will see that the claims for efficiency, based on these figures, fall to the ground. It should not be necessary to caution them against the mistake of plotting figures for unequal periods of time as Mr. Swindin did in the diagram he gave on page 68.

I do not wish to discuss the side issues of the matter, but with reference to Mr. Swindin's last letter I must point out that the slope of the Parsons line I obtained does not correspond to 7 lb., but to 8 lb. of water per pound of coal. Both my diagrams of January 4th, and the equation I gave, are explicit on this point. In any case his neglect of the constant term, in arguing about evaporation, vitiate the whole of Mr. Swindin's reasoning. Furthermore, his contention that the Parsons line does not apply to a single boiler is as astounding as the contention would be that the Willans line did not apply to a single engine. Both a boiler and an engine have a no-load consumption, in addition to a consumption varying with the output.

Referring once more to the five Lakeside tests given in Mr. Brownlie's paper, I would again point out that that gentleman must either withdraw four of these on the grounds that the flue gas temperatures are below 212 deg. Fah., or else he must withdraw the very emphatic statement in his book that boilers cannot be operated under such conditions. I leave the dilemma to him.

T. D. NAPIER.

Brondesbury Park, N.W. 2, February 6th.

RAILWAY ELECTRIFICATION.

SIR,—With reference to Mr. F. Sayers' letter in your issue of February 1st, I hasten to correct the slip which I made in stating that, as far as I remembered, the generator of the Chicago, Milwaukee and St. Paul motor generator is a single machine with 3000 volts across one commutator. I have now looked up the matter in the issue of the *General Electric Review* for April 4th, 1920, which copy, at the moment of writing, I had mislaid, and find that there are two 1500-volt generators in series on one shaft with the synchronous motor.

This, however, must not be taken to mean that there would be any difficulty whatever in working at 6000 volts, because it would only be necessary to have two such motor generators if it were required to work at 6000 volts across the outers of a three-wire system. The insulation of one of the two generators is designed to withstand 3000 volts above earth continuously, and, therefore, the conditions are exactly as they would be on a three-wire system designed to run at 6000 volts.

Presumably, the only reason why a 6000-volt three-wire system was not adopted was because there was not the necessary frequency of trains to make such a system workable. On a frequency of service of double, treble, or quadruple that now obtaining, say, between London and Birmingham, such as I gather Mr. Sayers is figuring upon, there would, no doubt, be quite a sufficient number of trains to make a three-wire system efficiently workable, and 6000 volts could, therefore, be employed.

Birmingham, February 4th. A. M. TAYLOR.

ELECTRIC LIFTS.

SIR,—In your abstract of Mr. Marryat's paper, published in your issue of 25th ult., it is stated that the author is not prepared to explain why the rope arrangement shown in *f*, Fig. 1, is so exceptionally destructive to the ropes.

I presume that whilst not to scale the diagram may be taken as roughly a general indication of the proportions of the parts of the machine. May I suggest that the cause of heavy wear are two-fold.

(*a*) Reverse bends in the rope close together. The distortion of the shape of the rope due to bending is not given time to die out before being given an opposite bend and distortion by the driving sheave.

(*b*) Slipping of the diverting sheave. This sheave has considerable inertia, and at the same time the arc of contact of rope and sheave is very small. Thus, the rope slips in the groove of the diverting sheave during both the acceleration and braking periods, during which energy has to be supplied to, or taken out of, this sheave by the friction between rope and sheave.

Taking the diagrams as you publish them, the same result might be expected from *b* with its top drive, but for the fact that in *b* there is no reverse bend, whilst in *f* such a bend exists under severe conditions, with the result that owing to distortion of rope individual wires are attacked in detail.

I have no special experience in "lifts," but it is common knowledge that wire ropes seldom break in the course of work, but are condemned owing to breakage of individual wires due to wear, and generally wear on the outside wires.

Angmering, February 2nd. GEO. T. PARDOE.

MARINE HOT-BULB ENGINES.

SIR,—I was very interested to read the letter by "Engineer-in-Chief" under the above heading in your issue of January 25th. The serious troubles he has experienced with his hot-bulb engines are, as he states, mainly due to the crank case being used for the compression of the scavenging air, thus preventing very liberal lubrication of the engine parts, so as to reduce the amount of lubricating oil which contaminates the scavenging air. Nevertheless, pollution of the scavenging air occurs in proportion to the amount of lubricating oil supplied to the engine. This passes to the cylinder and is wastefully burnt, causing many of the difficulties mentioned.

The hot-bulb engine has the merit of lower initial cost when compared with a Diesel engine, but I think if "Engineer-in-Chief" had Diesel engines under his control he would not have had so many complaints to make.

I quite agree with "Engineer-in-Chief" that the hot-bulb type of engine would be greatly improved if the scavenging air was taken from a separate chamber instead of from the crank case. The removal of the crosshead pin from the heat of the piston would also be a decided improvement for two-cycle hot-bulb engines, but such refinements would add to the initial cost.

London, February 6th. H. T. DAY.

SIR,—The letter of "Engineer-in-Chief," which appears in your issue of the 25th ult., is a recital of conditions we have been up against in the reconditioning of various classes of vessels delayed in port around this district. It has been our rule to record the various reasons of delay, and it is a fact, which makers will not deny, that lubrication on two-cycle enclosed crank case compression engines is the cause of much disappointment and anxiety in otherwise splendidly designed and constructed engines of this type on the market to-day.

It is with regret we notice the tendency of your correspondents to depreciate the two-cycle enclosed crank case type, as undoubtedly there is a continued demand for this class of engine, even with its known faults. We believe the solution of the lubricating problem for this class of engine effectively will not only add to the demand, but will be a real boon to users.

For S. RICHARDS AND CO., Ltd.,
S. S. G. RICHARDS, Managing Director.

Lowestoft, February 6th.

Railway Matters.

The train ferry between Harwich and Zeebrugge is to be opened about the end of the month.

THERE has been a very satisfactory decrease in the number of accidents on French railways. In 1912 the number was 209. It fell to 142 in 1920, to 72 in 1921, to 49 in 1922, and to 39 in 1923.

IT is reported from Brussels that a mission is leaving Belgium shortly for the Belgian Congo to survey the route Buta–Zobia–Bellogwe (Betongwe ?), with a view to the construction of a railway line to link the northern territory with the Cape-to-Cairo Railway.

THE interesting announcement is made that Mr. James Milne, an assistant to Mr. Pole, has been made the assistant general manager to the Great Western Railway. Mr. Milne started his railway career as a pupil at Swindon, and was in the locomotive department until he went to the statistical branch of the Ministry of Transport in 1919.

IN view of the interest that has been taken in the fact that the servants of the Underground Railways have not been participants in the railway strike, it may be remarked that the companies concerned are not parties to the railway conciliation scheme. Their men are in the same unions as the employees of other railways, but they have a conciliation scheme of their own.

THE French Government has asked the Superior Council of the Railways to consider proposals for increases of both passenger fares and goods rates. The proposed increases in passenger fares are said to vary from 47 to 50 per cent., while the suggested increase in goods rates is 12½ per cent. This measure is considered as part of the series of financial proposals for the rehabilitation of the franc.

THE question of station name-boards is receiving some attention just now. In this connection, two facts may be noted. The late Great Northern Railway for years duplicated its name-boards and fixed them at right angles to each other and at an angle to the line, so that the name was seen as a passenger approached the board, and, if he looked back, after he had passed it. On signal-boxes no other boards than the name of the box is allowed to appear.

THE work of surveying the route for the proposed broad gauge railway between Beirut and Tripoli, in Syria, has been begun, and a definite line has been traced out over thirty kiloms. of a total distance of 96 kiloms. The two parties which are surveying the route and estimating the probable cost of construction left Beirut and Tripoli simultaneously, and are expected to meet in about three months' time. The complete plan will then be drawn up in Paris, and it is hoped that the construction of the railway may be begun in five or six months' time. This line will link up Beirut with the Tripoli-Homs-Aleppo line, and thus with the Bagdad railway, which itself unites Constantinople and Mosul. It will also provide land communication between Paris and Beirut, by way of the Orient express, the Bagdad railway, the Northern Syrian-Cilician system, and the Syrian system. Another 100 kiloms. of line from Beirut southwards would link up with the Palestine-Egypt system, and communication would thus be established between Paris and Cairo by way of Syria.

ALL disputes between the American railway companies and their servants as to wages and conditions of service are, failing agreement between the local representatives, to be determined by an adjustment board—if it be a matter of grievances, rules or working conditions—or by the Railroad Labour Board if it be a question of wages or salaries. The Transportation Act, 1920, set up the latter body, which consists of three representatives each of the railways, the men, and the users of the railways. Unorganised labour is provided for and the Labour Board may take action on matters of grievances, rules and working conditions, where no adjustment board exists, also when the adjustment board concerned reports that it has failed or is likely to fail to secure agreement. No member of the Labour Board is to be in the employ of any organisation of labour or any railway company, or to be pecuniarily interested therein. Each is paid a salary of ten thousand dollars a year, and the secretary a salary of five thousand dollars. Where a local agreement has been arrived at that, in the opinion of the Board, will necessitate a substantial increase in the railway charges, the Board may suspend the operation of the agreement and hear the case itself. The decisions are not mandatory, but if a railway fails to put a decision into operation the Board may make public its decision in such manner as it may determine.

THE tubular shafts for the reception of the escalators at Stockwell on the City and South London Line, have now been completed, and the work of installing the escalator machinery is proceeding. The escalators will be of the reversible type, so that both may operate in the same direction if and when required. One of the principal improvements at the station besides the escalators will be the much increased size of the booking hall, which will have an area of 3000 square feet as against the 600 square feet of the old hall, and passimeters will displace the "hole in the wall" method of booking. A new multiple type of escalator equipment, by which three distinct moving stairways will work in one shaft, and which has other improvements over the type of escalator now in use in London—including a novel and much simpler method of boarding and alighting for passengers—is being put in at the new Clapham Common Station. Another advantage of this new escalator, which is particularly designed to deal with heavy night and morning traffic, is that any or all of the three staircases can be made to go in either direction at the same time, and what is even more important, they can be reversed practically instantaneously. Existing types of escalators cannot be reversed under 15 or 20 minutes. The new escalator is known as the "Comb Type," because, by an ingenious grill-like arrangement in the top and bottom platforms, passengers will be picked up and set down—combed on and off as it were—instead of having to steady themselves before stepping. The sideway step off as a passenger alights from the existing type of escalator is eliminated. Passengers will just walk on and off. The comb escalator is rather faster in speed than the older type.

Notes and Memoranda.

THE Council of the Institution of Electrical Engineers have made the third award of the Faraday Medal to Dr. S. Z. de Ferranti, a past-President of the Institution.

A REPORT of the Roads Dressing Sub-committee is to the effect that bitumen has no harmful effect on the life of fish in streams into which the drainage from the roads coated with that material finds access.

IN a technical paper recently issued by the American Bureau of Mines, it is stated that making tanks used for the storage of petroleum gas-tight, reduces evaporation to such an extent that the cost will be paid for in less than 100 days.

A USEFUL little handbook for miners, just issued from the Government Printing Office at Washington, contains illustrated descriptions of the principal self-contained mine rescue oxygen breathing apparatus, together with working instructions.

AT a recent meeting of the Newcastle and district branch of the Institution of British Foundrymen, the President, Mr. J. Smith, and several other speakers, suggested that bad castings might generally be attributed to improper operation of the cupola.

IN the course of the discussion of a paper on "Hydro-electric Equipment," at the Boston Society of Civil Engineers, Mr. W. M. White said that the Allis-Chalmers Company was getting out designs for units as large as 100,000 horse-power. He did not think, however, that single sets of over 150,000 horse-power would be built during this generation.

THE timber with which the 12-mile railway trestle across the Great Salt Lake in America is being repaired is being preserved by soaking in the lake itself. The water contains from 14 to 23 per cent. of saline matter, and after soaking for three months, the outside ½in. of the timber takes up 2 lb. of salt per cubic foot. The woodwork is all waterproofed after being put in place.

A NOVEL method of providing a floor on which to store cement in bags is described by a correspondent of the *Engineering News-Record*. He uses straw as it is delivered in bales. There are twenty-four bales to the ton, and each ton provides an area of 192 square feet. The bags are stacked from the centre of the floor outwards, so that the outside tiers tend to lean inwards. The writer says that although 6in. of flood water ran under the shed, not a sack of cement was lost.

IN the course of his inaugural lecture at the Ramsay Memorial Laboratory, Professor E. C. Williams mentioned a case where the expectations based on laboratory experiments were far from realised in practical application, and said, in this connection, that it was not just 'horse sense' that was required to prevent errors of this kind. Still, 'horse sense' would accomplish a good deal, and he would go so far as to say that frequently 'horse sense,' combined with a little chemical and engineering knowledge, had achieved more than an encyclopædic knowledge of chemical or engineering theory with no ability to apply it.

AFTER being considered by representatives of the South African mining industry, the Sekenke gold mine in Tanganyika has been bought locally and reorganisation is proceeding. In addition, the prospecting on the south-west border of Kenya has revealed a promising seam for which machinery has been ordered. The development company prospecting for coal in Tanganyika has ceased operations, but the export of mica is increasing. It is reported that oil has been found south of Lake Albert in Uganda, but until tests are made it is uncertain whether or not the find will prove commercially successful.

LECTURING recently before the Stoke-on-Trent Association of Engineers, Mr. H. W. Bannister said: "If one can produce a flocculent precipitate instead of a hard crystalline deposit, the control of scale has been considerably advanced, as the removal of the deposit would thus offer no real serious difficulties. By the application of colloidal methods this can be effected, and the method is particularly valuable when there is no treatment of the feed water outside of the actual boiler. By the addition of suitable chemicals, the scale salts are formed as a colloidal jelly, which has the power of taking up solid matter and maintaining a moisture content even at high temperatures experienced, instead of settling as a hard crystalline deposit."

THE Tata Steel and Iron Company in India is installing at Jamshedpur a 6300 horse-power motor, built by the General Electric Company of America. It is to be used to drive a combination rail and structural mill. The motor, which weighs 476,000 lb., has two armatures and one shaft. Its overall length is 25ft., its width 15ft., and height 12ft. 8in. This mill motor is capable of turning out enough 85 lb. rails in one hour to lay a two-rail track for 1.5 mile, or 200 tons of rails per hour. It is in two units, with armatures mounted on the same shaft, each unit developing 3150 horse-power. Its motive power will be derived from two 2500-kilowatt generators, working at 600 volts, and driven by a 6500 horse-power induction motor wound for 3000 volts. The latter motor will receive its power from the mill power plant. A fly-wheel of 110,000 lb. weight is to be employed.

IN connection with the investigation made by the American Bureau of Standards on steels for the manufacture of precision gauges, an effort has been made to find a quenching medium intermediate between oil and water. Some little time ago, quenching curves were taken of specimens cooled in water solutions of glycerine. Such solutions fill the gap effectively, so far as the cooling rates at high temperatures are concerned. On the other hand, glycerine and its water solution cool distinctly faster in the lower temperature ranges than quenching oil. This appears to be a desirable property. As a commercial quenching medium, glycerine or its water solutions should not be unduly expensive, for although the first cost is high, glycerine does not decompose to any great extent on heating, as is the case with oils. The composition of glycerine-water solutions may be easily maintained by hydrometer tests. The solutions do not give off irritating fumes and are harmless to the worker.

Miscellanea.

THE Penwithers Viaduct, on the Truro-Falmouth line, is being replaced by a new bridge.

THE local water supply scheme is to be extended so that the higher parts of Kingsteington can be supplied.

THE iron mines on Belle Island, Newfoundland, which have been closed down for two months, have been re-opened.

IT is proposed to erect some new coaling staithes at Port Clarence Wharf, on the Tees, with a capacity of 500 tons per hour.

THE schooner yacht which is being built by Krupps for an American owner is to be fitted with a gyroscopic stabiliser of the Sperry type.

A PLANT capable of gasifying 56 tons of coal per day of 24 hours, on the low-temperature carbonisation principle, is to be put up at the Springfield Paper Mills at Polton, Midlothian.

THE output of the sulphuric acid factories of Upper Silesia has now been increased, according to the *Chemical Trade Journal*, so that at least as much as 500,000 kilos. are produced per day.

IT is estimated that the cost of repairing the damage to the American liner Leviathan, which ran aground recently outside New York Harbour, will be about a quarter of a million dollars.

IT has been decided that an experimental explosion like that carried out at Oldenbroek on October 28th, 1922, shall be made in Central France next May on three different days and at different hours.

THE total value of the mineral productions in Tasmania during 1922 was £1,013,415, which represents an increase of £190,564, as compared with the previous year. Increases are recorded in the production of silver, lead, and pyrites, whilst decreases are recorded in gold, copper, and tin.

ACCORDING to a letter from the Russo-British Chamber of Commerce appearing in the December issue of the *Decimal Educator*, the metric system will be introduced officially into Russia on January 1st, 1927. Meanwhile it is being gradually introduced under the control of a special inter-departmental metrical commission.

WIRELESS communication between Dawson City and Mayo, in the Yukon Territory, is to be effected by the end of the year. Next year it is proposed to continue the erection of a chain of radio stations in the Mackenzie Valley, connecting with Dawson Station, and thus give telegraphic communication from the Yukon to Alberta.

THE output of the nickel mines of Canada in 1923 totalled 61,444,000 lb., valued at 18,433,000 dollars, an increase over the previous year of 43,846,877 lb. and 12,275,000 dollars in value. The 1923 production of nickel was by far the largest recorded, except during the four years 1915 to 1918 inclusive. The largest output during that period was in 1918, viz., 92,507,293 lb.

WHILE refusing a request for increased wages on the basis of the cost of living, the gold-mining industry of Johannesburg has decided to grant employees a monthly bonus in a fixed proportion to the amount of the gold premium. The bonus, which for January will be 6 per cent. on wages, is an acknowledgment of the increased efficiency of the majority of employees since the 1922 strike.

THE report of Mr. Palmer, to the Chinese Government, on the conservancy of the Yangtze River, is to the general effect that "the Yangtze is to-day an extremely serviceable river, and the comparatively trifling cost now incurred in carrying river-borne traffic during the winter months is shown to be less out of all proportion than the annual charge which would have to be met on even the simplest form of improvements."

EXPERIMENTAL silvicultural work is being conducted by the Canadian Dominion Forest Service at its forest experiment stations in order to determine the results of different methods of growth, thinning and cutting. Both coniferous and hardwood stands are under investigation, and different methods such as clear and selection cutting, thinning, removal of undesirable species, &c., are being fully tested with the object of ascertaining how best to secure good reproduction and rapid growth.

IT is reported from Washington that Judge Elbert Gary, chairman of the Board of the United States Steel Corporation, has informed President Coolidge that the elimination of the twelve-hour day in the steel industry had increased the cost of production approximately 10 per cent. Improvements and inventions in the manufacture of steel, Mr. Gary said, might reduce the additional expense somewhat, but he indicated that the industry had been placed on a higher cost basis as the result of the shortening of the working day.

THE recent award to M. Bienvenue of the gold medal of the Town of Paris was the first instance of an engineer, or other functionary, receiving that distinction during his period of active service. Aged about seventy-two M. Bienvenue has long passed the period for retirement, but in view of his eminent services he is still retained as General Inspector of the Technical Services and of the Port of Paris at the Prefecture of the Seine. His greatest achievement was the construction of the first sections of the Paris Metropolitan Railway, the line between Porte Maillot and Vincennes having been completed in time for the Paris Exhibition of 1900.

THE death has occurred at Redruth, at the age of seventy-six, of Mr. Thomas Henry Rowe, well known as an engineer in Cornish mining circles. His father, Mr. Daniel Rowe, was one of the principal engineers employed by the late Captain Michael Loom, of Gwennap, and supervised the erection of a large amount of machinery designed by Captain Loom in Cornwall and elsewhere in the British Isles as well as on the Continent. Mr. T. H. Rowe spent a number of years in South Africa and Mexico, and on returning to this country became associated with the late Mr. Nicholas Trestrail, of Redruth, on whose behalf he erected pumping engines and other mining plant all over Cornwall.

AIRCRAFT APPRENTICES' TRAINING CENTRE AT HALTON CAMP

(For description see page 139)

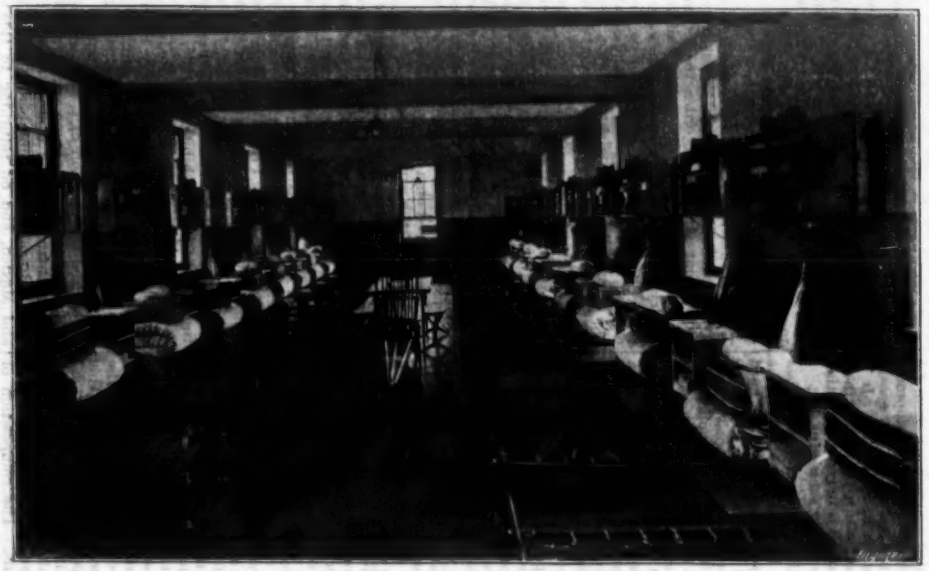


FIG. 4—ONE OF THE DORMITORIES

FIG. 5—A DINING ROOM

FIG. 6—ONE OF THE KITCHENS

FIG. 7—THE CAMP BAKERY

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THE ENGINEER.

FEBRUARY 8, 1924.

Unemployment Insurance.

OWING to the position occupied by the National Confederation of Employers' Organisations, we must regard the report on Unemployment Insurance which it made a few days ago to the Ministry of Labour as of the first moment. The National Confederation is not a body that comes often before the public eye, and probably many of our readers were not even aware of its existence. It may therefore be desirable to say that, as its name implies, it is a confederation of a large number of employers' organisations, not only in the engineering trades, but in many and varied trades. We do not know if it embraces all organisations, but it certainly includes some of the greatest, and is therefore in a position to draw from a large source of opinion and experience. It was in November, 1922, that Sir Montague Barlow, Minister of Labour at that time, invited it and the Trades Union Congress to make reports to him on the solution of the problem of unemployment. Since something over a year has passed since that request was made, we may assume that the report before us has been prepared after careful consideration and discussion. We should have been glad to be able to place the opinions of the workers, as represented by the Trades Union Congress, beside it, but the Congress has not yet reported. Many of the economists in Labour circles believe that insurance against unemployment by industries is both desirable and practicable, and it would have been useful to set their arguments against those of the National Confederation, which sees no possibility of applying that remedy.

Apart from some historical and general notes, the report we are considering consists of two main parts, of which the first is destructive and the second constructive. It may be anticipated that both will provoke lively criticism. In the first, the Confederation says bluntly: "Compulsory insurance by industries is quite impracticable on any comprehensive scale." In the second, it develops in some detail a "National Scheme of Compulsory Unemployment Insurance." With regard to insurance by industries, we cannot but feel that there is a great deal of weight in the arguments advanced by the Confederation against it. We agree, for example, that the demarcation of industries is extremely difficult, and in some cases impossible; that there is a floating industrial population which moves from industry to industry; and that there are industries which it is difficult to handle because of the lack of trade organisation, either on the side of the employers or the employed. The advocates of insurance by industries have recognised these difficulties, and have proposed as a means of getting over them that the indefinable section of the industrial population should be dealt with by the State. On this proposal the report remarks that if a "residual State scheme" were formed to link up all that did not fall into the individual industries scheme, "the real problem would be to determine the residue." Everyone who has given any attention to this vexed problem is well aware of this difficulty, and were it the only objection to insurance by industries, it might prove worth while to adopt one or other of the schemes that have been put forward for overcoming it. But even if it were surmounted, there remains another obstacle of almost as great importance. All industries are not equally well situated; some could afford to provide for more out-of-work benefit than others; but, in the opinion of the present reporters, "to have great disparity between either the contributions or the benefits would inevitably create unrest and dissatisfaction." If demarcation of industries were possible, then we should see but little weight in this contention. Just as there are now different earnings in different industries, so might there be different scales of contribution and different rates of benefit. But if demarcation is not practicable, if each industry cannot look after its own unemployed, then there appears to be no alternative but a National Scheme, and under such a scheme nothing, in the view of the Confederation, but rigid and uncritical equality would be tolerated. Indeed, the National Confederation says plainly that "the compulsory scheme should be based upon a flat rate of contribution and a flat rate of benefit, and should not discriminate between workers." It has, we believe, been observed before that if there is to be no kind of distinction, then, to be logical, compulsory insurance must be carried from the working classes to the clerical classes, and from them to the professional classes, and the lord equally with the labourer must be expected to "stamp his card." But it is worth bearing in mind, in considering this matter, that despite professions to the contrary, there are sharp social distinction in working-class circles, and it is at least open to doubt that the aristocrats of the Labour world would be content with what they would deem adequate out-of-work benefit for the "masses" of labour. Moreover, since Labour has favoured insurance by industries because it does not see why a well-paid and prosperous industry should pay for the support of one less favourably placed, we fear it would generally be found that a flat rate would cause as much discontent as an unequal rate. Indeed, we may venture the belief that the only scheme which would satisfy Labour would be one that gave workmen the same wages when they were out of work that they were in the habit of receiving when in work—or, in other words, that the State should give a guaranteed week to everybody! Of the economic impossibility and obvious hopelessness of such a proposal, we need not speak. They jump to the eye. But it has been put forward by Labour before now, and we may expect to see it arise once more, and before long. These considerations bring us naturally to what we have called the constructional section of the report. It is based on a detailed consideration of the administration of unemployed benefit during the last three and a half years. From what has preceded, it will be seen that the scheme is to give equal benefits to all insured persons. It is further proposed that the State shall pay fully one-third of the total combined contribution, instead of one-fourth as at present, and that the refund provision—under which a workman who had reached sixty years of age received back the total amount of his contributions, less what had been paid to him in benefits—should be withdrawn. Under the heading of Administration, the report insists that "in the interests of the efficiency and usefulness of the employment exchanges as the administrative machinery of the Insurance Fund, they should be the sole administering authority, and there should be no concurrent or partial administration by any other organisation." In other words, administration by trades unions must be stopped. To enable the exchanges to carry on the increased work, the Confederation foresees that they would have to be enlarged, but believes that "improved accommodation would permit of greater economy of staff." We need only add, in conclusion of this outline of the constructional policy, that it involves complete control by the State.

It will be seen from this summary of the report that it will meet with much opposition, but as a review of the conditions that have arisen from the Act of 1920, and as a clear-cut

policy based on that review, it forms unquestionably a good starting point for further discussion. We are unfortunately not told in the report how the opinions expressed and the policy advocated have been arrived at. It would have been, at least, satisfactory to know if each branch of the Confederation had made a separate report based on opinions collected from its own members, and if these opinions had then been carefully analysed by a General Council of the Confederation. We must presume that some such course was followed, but we should have been better pleased had a clear statement of the means employed in the preparation of the report been given. Moreover, as we have already remarked, the report presents only one side, the employers' side, of the case, and it is greatly to be regretted that the Trades Union Congress has not yet seen its way to express its views. Perchance, it may be led to do so now by way of criticism of the present document.

Electricity Supplies.

IN his presidential address before the North-Western Section of the Junior Institution of Engineers, Mr. S. L. Pearce, chief electrical engineer to the Manchester Corporation, dealt with electricity supply. Mr. Pearce needs no introduction to those connected with the electrical industry. His long and varied experience in the supply business enables him to speak authoritatively on generation, transmission and distribution problems, and his address, delivered in Manchester on Monday, January 28th, was quite instructive. On the question of utilising pulverised coal, his views are practically in agreement with our own. Only a real test under British conditions, he stated, will decide the issue. He seemed to doubt the statement that the initial cost of a pulverised coal plant is little, if any, greater than that of a modern stoker equipment, and it was difficult, he remarked, to appraise at their true value some of the figures relating to efficiency that have come from across the water. On other matters, such as air heating, and the bleeding of main turbines, his views were more definite. It was probable, he thought, that water economisers would be eliminated in the future, and that the heat from the flue gases would be utilised for pre-heating the air required for combustion to temperatures greater than those in use to-day. The bleeding of main turbines at two or more points in the steam expansion for the purpose of feed-water heating was considered to offer very promising results, especially as the system could be adopted in conjunction with closed feed-water heaters into which the exhaust steam from auxiliary plant could be led.

The important matter of overall thermal efficiency was naturally touched upon. It seems that when the new Barton station is working under normal conditions, a thermal efficiency of 22.9 per cent. is expected, the figure being based on the guaranteed performance of the plant. An efficiency of this order is not, of course, the maximum that has been claimed for a large high-pressure modern plant. Twenty-five per cent. is the figure contemplated in the case of at least one station that has been built in this country, and Mr. Pearce contends that this result will be realised at no distant date. But high thermal efficiency, as everyone knows, does not necessarily mean that all consumers will be supplied with electricity at relatively low rates. What we really need to look at is the price at which current is sold rather than the B.Th.Us. consumed per unit generated and supplied to the station bus-bars. That is the basis on which the merits of different systems of supply should really be judged, although, of course, fuel economy is very important. We do not suggest that those who are embarking upon super power station schemes are concentrating upon thermal efficiency and neglecting the question of cost, but we fear that it is well within the range of possibility that when these large stations have been built many consumers may find that they are very little better off than they were before. It is, as Mr. Pearce explained, possible to have a super power system built up of several public utility services acting in the closest possible relationship, and such a combination would give results not widely different from those obtained from any comprehensive single system. But although he admitted that it was often very difficult to show that a small station could not satisfactorily meet new demands for power by extending its plant, he argued that the concentration of plant in the largest and most economical stations would ultimately provide a given area with the cheapest system of supply.

The demand for cheaper electricity must, of course, be met, and no one imagines that 25 per cent. efficiency is the maximum that will ever be attained. Some new development, not now even conceivable, may entirely alter the situation and very quickly render the large stations which some engineers seem so anxious to build obsolete. It is therefore, we suggest, desirable to pursue the policy of erecting large power stations with caution, and it is wise to endeavour, as far as possible, to cope with new demands on economical lines by extending, improving and linking up existing stations. The difficulty connected with the supply of current to remote places from large central stations arises from the cost of transmission, and that is the main reason why it is sometimes difficult to convince a small supply undertaking that it is better for it to purchase current than to install new plant. Mr. Pearce believes, however, that the raising of electrical transmission pressures will help to overcome this difficulty, and if all small stations are ultimately to be abolished, we sincerely hope that it will. The Coal Conservation Sub-committee's report of 1918 dealt solely with the conservation of coal. From this point of view super power schemes appear perfectly sound; but on the question of how much cheaper current will become as the result of the establishment of large stations, up to the present we have heard very little. It is quite certain that if electricity is to play the great part in industry and in the domestic field that has been allotted to it, and if it is completely to oust gas, the prices charged for current must be materially reduced, and the extent to which that result can be secured with large steam stations with a possible station efficiency of 25 per cent. remains to be seen.

Electricity in Mines.

THE value of electrical research was well demonstrated at last Thursday's meeting of the Institution of Electrical Engineers, when Professor W. M. Thornton read a paper on "Some Researches on the Safe Use of Electricity in Mines." There is ample room for a wider application of electricity in the mining industry, for at the present time only 11 per cent. of the coal raised in England and Wales is cut by electricity, and it was estimated, a few years ago, that electric winders only represented 4.4 per cent. of the total horse-power used for winding purposes. Great efforts have been made to increase the safety of electrical machines and apparatus used underground, but that is no reason why further research work should not be undertaken. Practical experience and investigation have brought some valuable facts to light. At one time, for instance, it was not realised that electric bells might ignite gas and cause explosions. Dr. Thornton, we believe, was the first to direct attention to the fact that these bells could produce ignition and to introduce a safety bell. Unless the inductive voltage is suppressed an electric bell becomes a miniature magneto which, under suitable conditions, is apt to give rise to an explosion. Experiments have shown, however, that as long as the pressure across the trembler contacts does not exceed 25 volts, a bell can ring freely in the most explosive mixture of illuminating gas and air, a mixture which, of course, is very much more readily ignited than fire-damp.

Many tests have shown that with modern armoured cables the risk of open sparking, as the result of damage being done to the cable in consequence of a fall, is slight, especially in view of the fact that the possibility of an explosive mixture being present at the same moment is very remote. One of the most interesting facts revealed in Professor Thornton's paper is that when alternating current is used there is much less risk of igniting the weaker mixtures than when direct current is employed. The frequency of an alternating current supply has also been found to have a very marked influence on ignition. Alternating current is always safer than direct current when there is little inductance, but with the voltages and currents in use real security can only be obtained by the complete enclosure of switchgear and motors. The currents in lighting and signalling circuits, however, can be kept well within the limits of safety so far as a break is concerned, and ignition by the hot filament of a lamp can be prevented by some device designed to operate when the lamp is broken. The fact that the frequency of an alternating current has a bearing on the risk of explosion, and that high-frequency currents are less dangerous than currents of low frequency, have led Professor Thornton to suggest that the lighting of coal mines should be improved. At a frequency of 150 periods per second and a pressure of 200 volts, the lowest current for ignition on a lighting circuit is 23.5 ampères, whilst in the case of direct current it is 0.4 ampère. The ratio is, approximately, 60 to 1, which is quite sufficient to commend alternating current, but as there is no need to run lighting leads at such a high pressure as 200 volts, alternating current can be made to show up to very much better advantage. At a periodicity of 160 cycles and at a pressure of 15 volts, a current of no less than 175 ampères would be required to fire the most explosive mixture of 10 per cent. fire-damp when this current is broken in the mixture. Current for lighting and signalling, Professor Thornton points out, might be supplied from the same circuit, and with the requisite protective gear to keep the maximum current in the event of a combined short-circuit and break at less than 175 ampères, a very high degree of safety could be secured.

The main conclusion which the author arrives at is that for everything except haulages, which call for fine speed regulation, alternating current is preferable to direct current. From the point of view of incidental safety the advantage is with alternating current, not only on account of the small risk in connection with ignition, but also because of the relative freedom from faults. At Hebburn the number of small cable faults was reduced from 164 to 1 in a period of six years by changing over from direct current to alternating current. Another valuable feature of alternating current is that a faulty cable is found to dry itself out. These conclusions are very satisfactory, for apart from the increased safety alternating current is more easily provided than direct current. Large electric power stations only generate alternating current, and the supply of direct current involves conversion, which introduces losses and increases the cost. Far too much direct current has been used in this country in the past. There are, of course, instances in which it offers advantages; but with the introduction of new motors which work at unity power factor and motors which will run economically at different speeds, there is no need to use direct current to the extent it has been used in the past. We feel convinced, in spite of all arguments to the contrary, that alternating current will be employed on a very extensive scale in the future, not only for general industrial purposes, but also for working long stretches of main line railways.

Literature.

Engineering Non-ferrous Metals and Alloys. By LESLIE AITCHISON, D.Met., B.Sc., F.I.C., and WILLIAM R. BARCLAY, O.B.E., A.M.I.E.E. With an Introduction by Engineer Vice-Admiral Sir G. G. GOODWIN, K.C.B. London: Henry Frowde and Hodder and Stoughton. 1923. 300 pp. 21s. net.

THE science of metallography was developed to a very large extent in connection with the study of iron and steel, and it has been remarked on more than one occasion that it would have been much better for the early progress of the science had attention been given, in the first place, to some of the simpler alloy systems. During this early period of development, and partly as a consequence of the material studied being so highly complex, the metallography of steel was mainly the subject of academic discussions. The actual knowledge of the subject was small, and what was known was often concealed to a great extent in theories or personal opinions of doubtful reliability. During this period, the science of metallography was to a great extent ignored by the steel industry; actually over thirty years elapsed after Sorby had first published his results before steel masters, attracted no doubt by the fact that the new science could and did throw light on the causes of failures, attached metallographical laboratories to their works as routine departments. But having once obtained a footing in that industry, metallography has developed its usefulness and has shown that in the correlation of cause and effect, from which works procedure can be deduced from an examination of the material produced, it can and does render valuable assistance to the industry. There are several obvious reasons why this should be so. The iron and steel industry has an extensive trade, a large capital is involved, and small savings on individual processes become in the aggregate very large amounts. Moreover, the products of the industry are often very carefully inspected and tested for defects. It was therefore to the advantage of the manufacturer to investigate any defects which became evident in his finished product or during the

course of its manufacture, and to trace such defects back to their origin so that they could be eliminated.

In the non-ferrous industry, a rather different set of conditions has obtained. From the point of view of study, several of the alloy systems met with in it are ideal as a training ground for the student. They are much simpler than the iron-carbon system, and the student of metallography would be well advised to begin operations on some of them. The non-ferrous industry, however, has shown much less appreciation than the steel maker of the possibilities of the scientific control made available by metallography. His attitude is understandable from the nature of the products of his business. To a great extent, they are not subjected to the same close inspection and tests for internal defects as much of the product of the steel industry. For this reason, the non-ferrous manufacturer has had less regard than the steel maker for the origin of his raw materials; he has not paid such close attention to his melting and casting methods in order to eliminate all the defects liable to be introduced during these stages of the manufacture of his products, and he has not developed, to the same extent as the steel maker, the art of deducing the past history of a sample from its appearance.

The authors of the present volume have endeavoured to analyse the established practice of the non-ferrous industry on metallographical lines, and to give an account of those properties of the metals used in that industry, which have an important bearing on the satisfactory use of these materials, in such a manner as to be understandable by those, whether makers or users of the alloys, whose previous knowledge of metallography and its methods is slight. In order that such an analysis and description of properties and their variation among different alloys may be intelligently appreciated, a certain amount of modern metallographical knowledge is essential, and hence, in the first part of the book, the authors present an account of the essential principles of scientific metallurgy—casting, working, testing, &c., of metals—in terms adapted to the requirements of the non-scientific reader, and they follow this introduction, in the second part, by a detailed description of the properties of specific metals and alloys.

With regard to the first part, it is satisfactory to note that the authors lay great stress on the importance of casting conditions. These "birth-marks," as they appropriately name the characteristics impressed in the metal in the casting stage, are sometimes absolutely indelible by any subsequent operation short of remelting. In emphasising this fact, they say "probably no other fact in practical metallurgy is of such vital importance to the user of metals. Unfortunately, the standard of excellence in cast non-ferrous metals hitherto attained has not been high or even satisfactory." It is to be hoped that the authors' efforts will assist materially in improving this undesirable state of affairs.

Speaking generally, the chapters in this part of the book are clearly written. There are, however, several points to which exception could be taken. For example, the commendable efforts of the authors to emphasise the importance of casting conditions are not helped by the inclusion of a diagram purporting to show the probable extent of pipe in a "narrow end up" ingot of very pronounced taper, which indicates that the pipe in such an ingot is confined to the top 20 or 25 per cent. of the ingot. Again, in their desire to present metallurgical knowledge in its simplest form, the authors admit that they have "occasionally used scientific terms in a way that perhaps would not withstand the most rigorous scrutiny of the academic metallurgist." The advantages of such a course may be open to question at any time; in the present case, however, the application of this "simplification" in describing the effects of cold work on metals is somewhat unfortunate, especially if one considers the mental efforts of the learner who endeavours to reconcile the authors' description of the production of twinning by cold work and its subsequent more or less complete removal by annealing with what he finds in other text-books, and also, of still more moment, what he will find when he prepares and examines his own specimens.

The chapter dealing with the mechanical properties of metals and mechanical testing contains a great deal of useful information, though possibly the views of the authors with regard to some of the methods of testing will not meet with universal approval. Such a chapter as this, however, in which the authors discuss the various methods of testing in relation to their value as criteria for the performance of the metals under working conditions, is of great value, even if the authors' opinions are not entirely accepted, in that it may lead to thought and discussion as to whether some of the present methods of testing, inherited from the days when wrought iron was the chief structural metal, are really as valuable in relation to modern alloys as they undoubtedly were for the material for which they were designed.

In the second part of the book, the authors deal in detail with the groups of alloys generally used in engineering work. Copper, nickel and aluminium, and their respective alloys, are discussed in separate chapters, while a fourth describes such miscellaneous alloys as bearing metals, solders, fusible metals and die casting alloys. In addition, a further chapter deals with the choice and specification of a non-ferrous alloy, and contains some useful and suggestive thoughts. In these chapters the authors have collected together, from a variety of sources, a great deal of useful information with regard to alloys, and have combined with it some excellent descriptive matter. The information given here should be of great value in assisting engineers to select non-ferrous alloys for specific purposes according to the properties required for those purposes, and not, as is so often the case, according to tradition or trade usage.

Chemistry and Metallurgy: Metals and Metallic Compounds. By ULICK R. EVANS, M.A. London: Edward Arnold and Co. Vol. III.: "The Transition Elements" (14s. net). Vol. IV.: "Metals of the B Group" (18s. net).

THE two volumes before us complete Mr. Evans' large work, and deal in considerable detail with the "transition elements" covering iron, nickel, cobalt, and the platinum group, and with the metals of the "B" groups, including copper, silver, gold, zinc, cadmium, mercury, tin, lead, arsenic, antimony, bismuth, and certain of the rarer metals which are grouped with them, such as gallium, indium, thallium, &c. The compilation of these volumes, and the compression of matter covering so wide a field into totals of 350 and 270 pages respectively, constitutes a truly enormous task which, from one point of view at least, the author has achieved with considerable success. The facts and ideas are presented with commendable clearness and in language which is free from much of the roughness which often marks technical writing. The books, consequently, are considerably more readable than is usual in compilations which aim at embracing such a width of subject that each branch must of necessity be treated in a decidedly summary fashion.

In considering the contents of these volumes in detail, one cannot fail to be impressed with the exceeding difficulty of the task with which the author was confronted. This difficulty will be fully realised when it is pointed out that, for each of the metals, he endeavours to deal not only with the general chemistry of the element and its compounds, but also with its mode of terrestrial occurrence, the more important methods of reduction and refining, and its technology and uses. Such information, in the case of iron alone, could easily occupy the whole of two such volumes, without going into excessive detail. The effort to compress so much information into a small space has been bravely made, and some degree of success has been achieved; but the question presents itself whether it has been worth while—whether, indeed, there is any real need for a book of this kind.

This attitude of mind towards Mr. Evans' work arises from the thought that the endeavour to combine the chemistry of the metals with an account of their metallurgy and their technology cannot really meet the needs of either the chemical or the metallurgical student. For the would-be chemist, the chemical side of the subject is insufficiently detailed. As an illustration we may take the brief sections—generally only a page or two—devoted to the analytical aspects of the chemical behaviour of each metal. To the man interested in the analysis of such metals, these sections are far too general and lack all necessary detail, while to the more general student the analytical behaviour of the metals is surely a matter of very minor interest. Similar criticism applies to the way in which metallurgical and technological processes are treated. There is far too much detail for the student of general chemistry, but, on the other hand, far too little for the man specialising in metallurgy. It is the plan of Mr. Evans' book, rather than its execution, which is open to criticism in this respect; the defects in question are scarcely avoidable when an attempt is made to cram two or three branches of science into a single work of this kind.

Turning to more detailed points, we notice with regret that Mr. Evans persistently speaks of "micro-photographs" instead of following what is now well-established and sound practice in calling them "photo-micrographs." Incidentally, the very few examples given in the frontispieces of the two volumes can hardly rank as equal to the best work of this kind now available. Numerous other points might be mentioned in which the volumes fail in detail to come up to the highest standard. Thus, the whole of the difficult subject of the physical metallurgy of steel is treated clearly, if briefly; but the equilibrium diagram fails to take note of recent work on the interesting allotropic transformation to "delta iron" at very high temperatures, although this transformation is mentioned in connection with the X-ray work of Westgren. Perhaps the most serious error, however, which we have detected—and the presence of some errors in a compilation of this kind is unavoidable—occurs in the account of the reduction of iron in the blast-furnace—Vol. III., page 66—where the maximum temperature in the hottest part of such a furnace is given as 3800 deg. Cent. It is a little difficult to conceive where Mr. Evans obtained such a value. If he had had the opportunity of glancing through the peep-holes of a blast-furnace tuyere in action, he would have immediately realised this fact. The temperature named would not only lead to immediate fusion of all the refractories of which such a furnace is constructed, but would volatilise the iron. One would assume that this must be a simple misprint, were it not that correspondingly high temperatures are given for the higher parts of the blast-furnace.

Another point where the author lays himself open to criticism is in his chapter on magnetism. That the subject, as a whole, should be treated in connection with the iron-cobalt-nickel group of metals is, perhaps, reasonable; but is it necessary, or desirable, to take up space in such a treatise with an extremely elementary account of the principles of dynamo-electric machinery? To combine chemistry and metallurgy in one work is a great task; to attempt to include not only elementary physics, but electrical engineering, makes it hopeless.

In spite of the criticisms in principle and in detail which the book invites, it is to be hoped that it may prove useful to some of those for whom it is intended; one cannot read it without gaining the impression that the author not only possesses a very wide fund of information and has taken much trouble in the matter of his references, but that he is a scientific writer of considerable promise and ability. Such writers are not very numerous, and it is to be hoped that he will give us books perhaps less ambitious in their scope, but of more concentrated value.

BOOKS RECEIVED.

Hydraulics. By E. H. Sprague. London: Scott, Greenwood and Son, 8, Broadway, Ludgate, E.C. 4. Price 8s. 6d. net.

Empire Forestry Journal. Vol. II., No. 2. December, 1923. Published by the Empire Forestry Association, Imperial Institute, S.W. 7. Price 4s. net.

International Review of the Science and Practice of Agriculture. October–December, 1923. Published at the International Institute of Agriculture, Rome.

The Colliery Manager's Pocket-book, 1924. Published by the *Colliery Guardian* Company, Limited, 30/31, Furnival-street, Holborn, E.C. 4. Price 3s.

Clubs, 1924. Edited by E. C. Austen-Leigh. Published by Spottiswoode, Ballantyyne and Co., Limited, New Street-square, E.C. 4. Price 7s. 6d. net.

The Syndicated Supply of Electricity on the North-East Coast, and the Abuse of Statutory Powers. By Andrew Gemmell. Newcastle-on-Tyne: R. Mayne, 318, Scotswood-road. Price 6d. net.

What Industry Owes to Chemical Science. Second edition revised and enlarged. By Richard B. Pilcher and Frank Butler-Jones, with an introduction by Sir George Beilby. London: Constable and Co., 10-12, Orange-street, Leicester-square, W.C. 2. Price 6s. net.

Books of Reference.

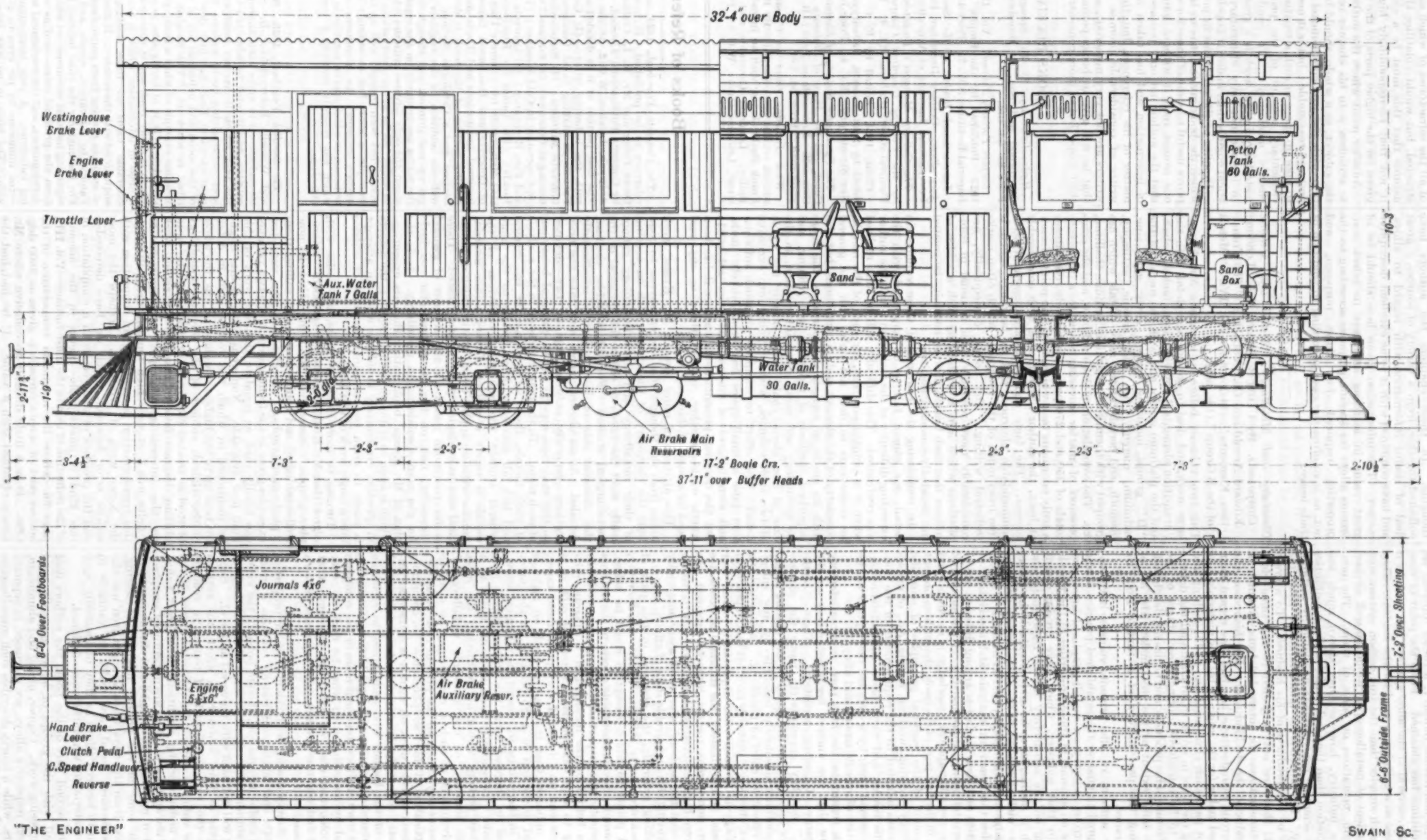
The Concrete Year-book, 1924, is the latest book of reference to be published. It has been edited by Dr. Oscar Faber and Mr. H. L. Childe, and it is published by Concrete Publications, Limited, of 4, Catherine-street, Aldwych, London, W.C. 2, at the price of 2s. 6d. net. The first portion of it is divided into thirteen chapters with the following titles:—(1) Cement; (2) Essential Factors in Making Good Concrete; (3) Proportioning Concrete Mixtures; (4) Standardisation in the Proportioning of Concrete; (5) Surface Treatment of Concrete; (6) Concreting in Cold Weather; (7) Reinforced Concrete and Fire Resistance; (8) Concrete Floors; (9) Concrete Roads; (10) Tables for Reinforced Concrete Design; (11) Memoranda for Concrete Users; (12) Bibliography of Concrete and Reinforced Concrete; and (13) Professional Institutions and Trade Associations. The concluding portion of the book is devoted to a Directory Section and a Catalogue Section. The whole forms a welcome addition to the engineer's library. It is well got up and printed, and though the figures in some of the tables are certainly on the small side, that is, really, about the only adverse criticism which we feel prompted to make. As far as our observations have gone, the subject matter has been brought well up to date. There is, for example, a short but exceedingly interesting and well-written reference to aluminous and quick-hardening cements, in which special mention is made of *ciment fondu*, which has recently received a considerable amount of attention.

The Swedish Year-book, 1923. Stockholm: Almqvist and Wiksells Boktryckeri-A.-B.—Sweden is increasing its endeavours to make itself known to the people in this country, and it must be admitted that it is carrying out the task which it has set itself exceedingly well. We keep on receiving books written, for the most part, in most excellent English, which deal with various aspects of the social and industrial life of the country, and the latest to reach us—"The Swedish Year-book, 1923"—is a fine example of what a really good book of reference should be. It is of handy size, is printed in plain type, which is easily read, and it contains in its 250 odd pages a mass of information which is calculated to be of considerable value to those seeking to become better acquainted with the country. It deals with a large number of subjects ranging from particulars regarding the Royal Family to education, sports and travelling facilities. For the engineer the chief interest lies in the data given regarding national resources—of which iron ore and timber form the principal items—and as concern hydro-electric developments, and the mechanical and electrical engineering industries. A very large number of other subjects—too numerous by far even to give a list of—is dealt with. The book in no way lags behind others which have gone before it in the wonderful correctness of the English in which it is written.

DOUBLE-BOGIE PETROL RAIL CAR FOR THE BARBADOES GOVERNMENT RAILWAY

THE DREWRY CAR COMPANY, LIMITED, LONDON, ENGINEERS

(For description see opposite page.)

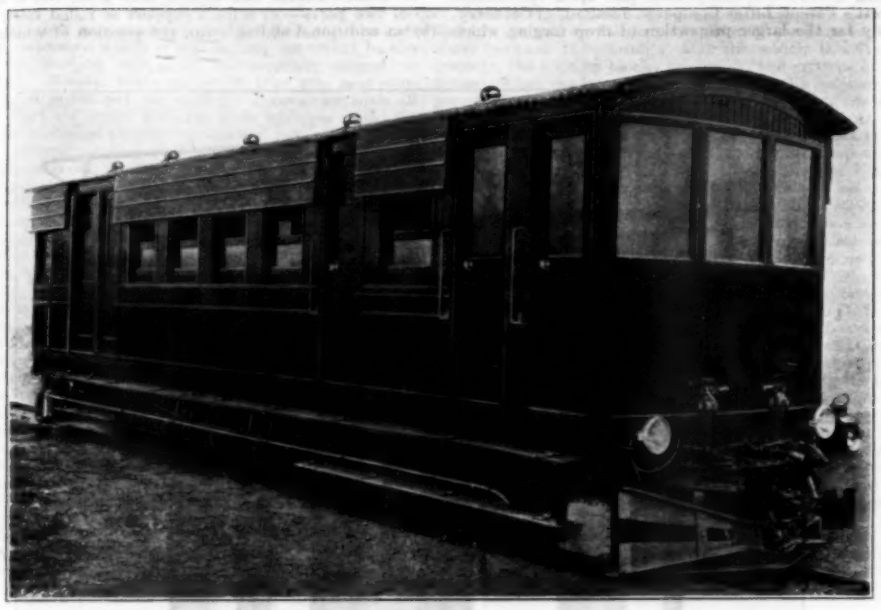


"THE ENGINEER"

SWAIN Sc.

DOUBLE-BOGIE PETROL RAIL CAR FOR BARBADOES

THE DREWRY CAR COMPANY, LIMITED, LONDON, ENGINEERS



A Double-Bogie Petrol Rail Car.

WE recently attended the trials of the chassis for a new petrol-driven narrow-gauge car, which has been made for the Barbados Government Railway by the Drewry Car Company, of 13, South-place, London, E.C. 2, and in view of its rather unusual construction, we reproduce, on page 152, a line drawing showing its general arrangement, while the half-tone engraving above gives an impression of the car's general appearance.

This vehicle is exceptional, among petrol rail cars, in that it has two bogies, and consequently can safely negotiate very sharp curves, while the power provided by the engine enables it to climb quite steep gradients. It will, in fact, go up a slope of 1 in 28, while rounding a curve of 250ft. radius at a speed of 5 miles per hour, or at 4 miles per hour when hauling a trailer. The speed on the level is intended to be from 15 to 18 miles per hour, and we timed the car during the trials on the Leek and Manifold Valley Light Railway to be well over 16 miles per hour on several occasions.

On reference to the line drawing, it will be seen that the engine is placed at one extreme of the framing, and drives the bogie at the opposite end. Immediately behind the engine there is the usual clutch, which drives a shaft reaching to the change-speed gear-box, situated about the centre of the vehicle. Another shaft continues the drive backwards to a second gear-box mounted on the framing of one of the bogies. Universal joints are arranged in the shaft over the pivot of the bogie and at the gear-box to accommodate the movement of the bogie as it rounds curves and rises or falls with inequalities of the road. The gear-box on the bogie has bevel wheels for driving a transverse shaft and also a reverse gear. From the transverse shaft, silent chains drive one of the bogie axles, with which the other axle is connected by means of side rods. The bogie at the other end of the vehicle is not driven, and the chain which can be seen running round a sprocket on one of the axles is merely for driving an air compressor used to operate the brakes. There is a driving position at either end of the coach, and the control levers are so arranged that they can be readily moved from one end to the other.

The engine has four cylinders, 5½in. in diameter by 6in. stroke, and when using petrol as fuel will develop from 60 to 65 brake horse-power. The normal speed is 1000 revolutions per minute. Ignition is effected by means of a high-tension magneto with a trip starting gear. There is an electric starter and a dynamo for lighting the coach.

The gear-box, in which all the wheels are machined from the solid, case-hardened and ground, provides three speeds, namely 4, 10 and 15 miles per hour, with the engine running normally.

The frame is constructed of steel channels, braced by transverse cross stays, angles and gussets, and is provided with a central channel frame to carry the engine and transmission, and also the buffer and draw gear. The bogie frames are of steel plate with cross members of channel section, riveted together by angles and gussets, and carrying the bogie centre and side bearer plates. The axle-boxes and guides are of cast steel. The boxes are fitted with heavy brasses, arranged for syphon lubricators and spring pads. The springs are of coil form. The wheels are 2ft. diameter, and have cast iron centres fitted with rolled steel tires, 2ft. diameter on the tread by 4½in. wide and 2in. thick. The gauge is 2ft. 6in. The axles are made according to the British standard specification for main axles, having journals 4in. diameter by 6in. long.

The tanks are of steel throughout, acetylene welded, and the water tank has a capacity of 30 gallons, while that of the petrol tank is 60 gallons. The cooling water for the engine is provided by a centrifugal pump driven by the engine, and radiators, of tubular form, are arranged at each end of the coach.

Sanding gear, to sand the driving bogie when running in either direction, is provided, and is worked from both ends.

Hydro-electric Progress in Canada during 1923.

THAT the year 1923 was one of marked activity in the development of the Dominion's water-power resources is evidenced by a review made by the Dominion Water Power Branch, Department of the Interior, of the principal undertakings from coast to coast. This indicates that some 255,000 horse-power were added during the year, bringing the total water horse-power installed in Canada to 3,228,000. The most significant feature, however, is the large number of projects actually in progress of construction or actively in prospect. These projects when complete will add to Canada's total more than 900,000 horse-power.

BRITISH COLUMBIA.

Hydro-electric construction activities were carried on in British Columbia during 1923 at widely separated points. In the northern coastal district the Granby Consolidated Mining and Smelting Company completed the construction of a large storage dam on Falls Creek and added a 5000 horse-power unit in its hydro-electric station. The Pacific Mills, Limited, at Ocean Falls also extended its water storage facilities by raising its dam an additional 15ft., and added a new 6300 horse-power unit in its hydro station.

The work carried on for the past two years by the British Columbia Electric Railway Company in raising its dam at the outlet of Stave Lake was completed during the year, and plans were laid for extensive new developments on the Stave River which will yield an additional 115,000 horse-power. In this connection tenders were being called towards the end of 1923 for a new unit of 25,000 horse-power to be erected and in operation during 1924. The East Kootenay Power Company actively carried on the construction of a new plant on the Elk River near Elko to have an initial installation of 15,000 horse-power and an ultimate capacity of 24,000 horse-power. With regard to prospective developments it has been stated that the West Kootenay Power and Light Company is planning to double its capacity at Bonnington Falls on the Kootenay River. It is also of interest to record a comprehensive report made by Kerry and Chace, Limited, consulting engineers for the City of Vancouver, with regard to a systematic development of adjacent water powers by the city.

ALBERTA.

The only hydro-electric project proceeded with in Alberta during the year was a small development undertaken by the Dominion Parks Branch of the Department of the Interior on the Cascade River for the supply of Banff. This installation of 960 horse-power was nearing completion at the end of the year. A new contract was made by the Calgary Power Company with the City of Calgary for a term of five years which was mutually advantageous to both parties, the company agreeing to construct an additional transmission line during 1924 from its power plants on the Bow River to the city.

MANITOBA.

The initial stage of the Manitoba Power Company's hydro-electric development on the Winnipeg River at Great Falls was brought to completion, and two 28,000 horse-power units are now in operation. Plans are under way for the addition of a third unit of similar capacity during 1924. The ultimate installation will comprise six units. The City of Winnipeg towards the end of 1923 awarded a contract for three new units of 7000 horse-power each to be installed in the municipal hydro-electric station at Point du Bois on the Winnipeg River. This will bring the total capacity to 82,000 horse-power with provision still remaining for two additional units.

ONTARIO.

The development work of the Ontario Hydro-Electric Power Commission ranked first in Ontario during the year. At the Commission's gigantic Queenston plant on the Niagara River two new 55,000 horse-power units, numbers five and six, were brought into operation. It is expected that units seven and eight will be installed in 1924, which will bring the capacity to 440,000 horse-power; the ultimate total of 550,000 to 600,000 horse-power being reached by 1926. A new 20,000 horse-power unit was installed in the Ontario Power Company plants operated by the Commission at Niagara Falls, this unit replacing a similar one which was destroyed in 1921. A new plant of 1200 horse-power was constructed at Bingham Chute on the South River to serve the Nipissing system, and work was started on the installation of a new pipe line at Eugenia Falls. On the Trent River the construction was commenced of two new developments, at Dams 8 and 9, of 6600 horse-power and 4800 horse-power respectively. These will serve the Central Ontario system and are expected to be in operation this year. Operations were also commenced on the addition of two new units of 12,500 horse-power each in the Cameron Falls Station on the Nipigon River to serve the Thunder Bay system.

In the mining district of Northern Ontario the Northern Canada Power Company brought into operation its 8000 horse-power plant at Sturgeon Falls on the Mattagami River to serve the gold mines in the Porcupine area. The Great Northern Power Company also brought into operation its station at Indian Chute on the Montreal River with two units of 2000 horse-power each. This company plans to add a similar unit in 1924. Construction was started of a 25,000 horse-power development by the Hollinger Consolidated Gold Mines Limited, at Island Falls, on the Abitibi River, with the expectation of delivering power at the company's mine and mill in 1924. The Spruce Falls Company completed a 2500 horse-power development at Kapuskasing on the river of the same name for use in connection with a sulphite pulp plant at that point. In the Kenora district the Backus-Brooks Company installed two additional 1200 horse-power units in its power-house at Kenora, and with four more of the same capacity installed early in 1924, the station will have a total capacity of 12,000 horse-power in connection with the company's pulp and paper mill. The Dryden Paper Company also completed an installation of 1400 horse-power on the Wabigoon River.

QUEBEC.

In Quebec construction operations were actively carried forward on numerous developments, several being of large magnitude. At the Cedars plant of the Montreal Light, Heat and Power Consolidated on the St. Lawrence River two units of 11,300 horse-power each, were added with two further units of the same capacity to be added this year, which will bring the total capacity to 200,000 horse-power. The St. Maurice Power Company achieved remarkable progress in the construction of its 120,000 horse-power development at La Gabelle on the St. Maurice River, and expect to deliver power during April next. The Southern Canada Power Company awarded the contract for a 37,800 horse-power development at Hemming Falls on the St. Francis River and construction work was placed under way. It is expected to have this plant ready for operation early in 1925. In the Ottawa district the Ottwa River Power Company commenced the construction of a development at Calumet Falls on the Ottawa River near Bryson, Que. This plant will have an initial installation of one or two units of 22,500 horse-power each and an ultimate capacity of 67,500 horse-power. The initial installation is to be ready for operation by January, 1925. In the Lake St. John region the largest individual development in the Province is under way at the Grand Discharge on the Saguenay River. This plant, which is being constructed for the Quebec Development Company, is to have an initial installation of 320,000 horse-power. Good progress was made on the work of construction during 1923. The plant is expected to be in operation early in 1926. In the same region Price Brothers and Company, Limited, completed the installation of an 11,000 horse-power development on the Chicoutimi River at Chicoutimi for use in their paper mills at Kenogami. The town of Jonquiere is also installing 1800 additional horse-power in its plant on the au Sable River.

On the south shore of the St. Lawrence the Lower St. Lawrence Power Company completed a hydro-electric installation of 3700 horse-power on the Metis River to supply the district extending from Rimouski to Matane. A small development of 550 horse-power was also installed by the Town of Megantic on the Chaudiere River. On the lower north shore of the St. Lawrence, the St. Regis Paper Company commenced the construction of a 600 horse-power hydro-power plant two miles east of Godbout River. In the north-western part of the province the Northern Canada Power Company secured a lease from the Quebec Government of a site on the Quinze River and immediately commenced construction. The initial installation of 20,000 horse-power is expected to be completed in 1924, when the power will be transmitted for use in the gold mining district of Northern Ontario.

Among other water-power activities in Quebec during 1923 may be mentioned a development for the Laurentian Hydro-Electric, Limited, on the East Branch of the North River—1865 horse-power; a new development of 1200 horse-power for J. C. Wilson, Limited, on the North River near St. Jerome; an additional capacity of 4500 horse-power to the plant of the Portneuf Hydraulic Company at St. Alban on the Ste. Anne de la Perade River; a 50-kilowatt hydro-electric plant on the Mattawin River near St. Michel des Saints; a 600 horse-power hydro-electric plant replacing a waterworks plant at Buckingham on the Lievre River, and a 1350 horse-power hydro-electric plant on Mars River near Bagotville.

In addition to those actually under construction several water-power projects are in active prospect in different parts of Quebec Province. They include a 15,000 horse-power plant on the Batiscan River, a plant of 80,000 horse-power at Lachine rapids on the St. Lawrence River; a 50,000 horse-power development on the des Prairies or Back River; two projects on the Gatineau River, the first at Chelsea of 110,000 horse-power and the other at Paugan Falls of 60,000 to 100,000 horse-power; a development on the Megiskan River in Northern Quebec of

10,000 to 20,000 horse-power, in connection with a pulp and paper mill, and a 21,000 horse-power plant on du Loup River, Maskinonge County, near St. Paulin.

Of great importance to hydro-electric development in the Province of Quebec is the work of the Quebec Streams Commission. The Commission has carried out most valuable storage works, such as the Gouin Reservoir on the St. Maurice River, the Allard Reservoir on the St. Francis River, and reservoirs on the St. Anne de Beaupre River. It is engaged at present on a dam to cost 2½ million dollars at Lake Kenogami in the Saguenay district, which will most beneficially regulate the flow in the Chicoutimi and au Sable Rivers to the advantage of the pulp and paper industries at Chicoutimi and Kenogami. The Commission also has under way storage improvements in the basin of the Metis River, at an estimated cost of 200,000 dollars. Another storage reservoir which was recently completed with the approval of the Commission, was one on Lake Jacques Cartier to regulate the flow of the river of the same name.

New Brunswick.

At Aroostook Falls on the river of the same name, the Maine and New Brunswick Power Company completed extensive alteration to its hydro-electric development, and replaced two old units of 750 horse-power capacity each by new units of 2000 horse-power, thereby bringing the total capacity of the plant to 8400 horse-power. A transmission line taking power from this plant is under construction, running from Bridgewater, Maine, to Woodstock, N.B., *viâ* Lakeville, Centreville and Hartland. The largest undeveloped power site in the Maritime Provinces, Grand Falls on the St. John River, has been under study by the New Brunswick Electric Power Commission during the year, with the possibility of development being undertaken if all conditions are found favourable.

Nova Scotia.

The most notable construction work in Nova Scotia during 1923 was that carried on by the Nova Scotia Power Commission at Malay Falls on the East River Sheet Harbour. This development, which comprises three units with a total capacity of 5500 horse-power, was well advanced during the year, and is expected to be in operation early this year, when power will be transmitted for use in a number of towns in Pictou County. Final arrangements were also made by the Commission for a second development on East River Sheet Harbour to furnish power to the Albany Perforated Wrapping Paper Company of Albany, N.Y., for a pulp and paper mill at West River Sheet Harbour. This development, which will have an initial capacity of 6000 horse-power with provision for an increase to 9000 horse-power is of particular interest in as much as it is attracting a new industry to the Province. The Avon River Power Company practically completed a development of 2300 horse-power on the Avon River to serve the town of Windsor. Work was started on the plant of about 100 horse-power situated on a small stream known as East River. The power will be transmitted a distance of about 6 miles for use in the town of Lockport.

New Type of Drop Hammer for Multiple-Die Stamping.

A new type of drop hammer, furnished with several improvements, so as to fit it specially for multiple-die stamping work, has recently been put upon the market by Brett's Patent Lifter Company, Limited, of Coventry.

In by far the larger proportion of drop forging which is carried out in this country, the dies contain only one impression—in the centre—which results in the metal being operated on presenting a central resistance to the impact of the tup. Working on these lines it is necessary to have a roughing out or dummying process, which involves the use of one dummying hammer to, say, each two drop forging hammers. There is, however, a growing tendency in the direction of using multiple dies, and in that way to avoid the need for using the roughing or dummying hammer. The main object of the new design of hammer which we are about to describe is to provide a structure which has the requisite strength and resistance to withstand, without fracture, the abnormal stresses set up by the hammer when delivering a one-sided blow. The guide rods of drop hammers of the ordinary type usually consist of cast iron or cast steel bars fitting into the anvil block at the lower end and supported at the top in a box with wood wedges. This method of constructing and erecting the guide rods has proved to be successful and efficient under ordinary drop forging conditions—that is to say, when the dies only contain a central impression; but fractures have occurred when it has been sought to use multiple dies, and even, be it said, when working with single dies.

In Messrs. Bretts' new design, each guide rod is made up of two parts—(*a*) a main support of rolled steel, and (*b*) an additional sliding strip, the position of which can be adjusted in a vertical direction. In the smaller sizes of hammer, the main support may be simply a rolled steel joist, but for larger sizes built-up girders, reinforced with steel plates, are employed. For the smaller sizes, too, the main supports may be let into the anvil block in the ordinary manner, but for heavy hammers the guide rods are, preferably, kept entirely separate from the block and their lower ends embedded in concrete. In both small and large hammers, however, the main supports are set at a permanent angle, sloping slightly inwards towards one another at the top, and their inner faces are machined, as are also the corresponding faces of the sliding strips, which are tapered in such a way that their inwardly facing edges are always parallel one with the other, no matter what their vertical positions may be. The height of these sliding strips is adjusted by means of a worm and wheel, or some equivalent screw device

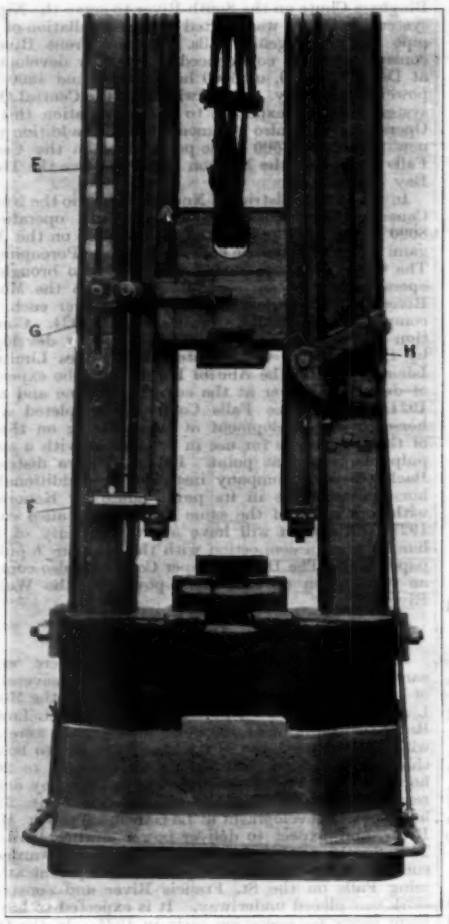


FIG. 1—FRONT OF LOWER PART OF HAMMER

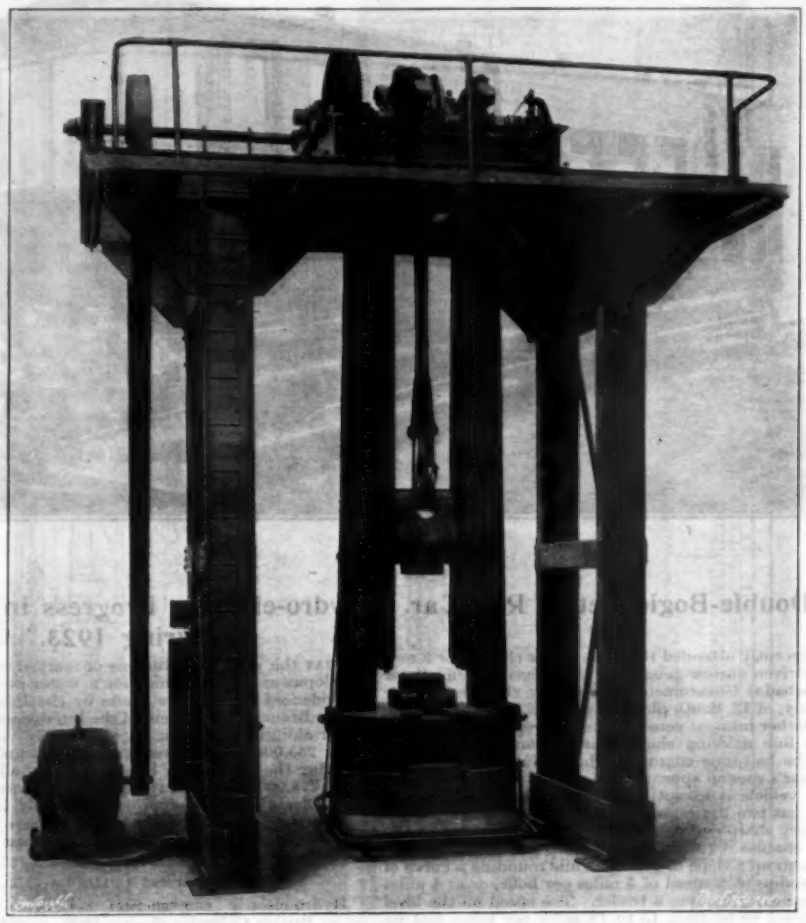


FIG. 2—BRETT'S DROP HAMMER FOR MULTIPLE-DIE STAMPING

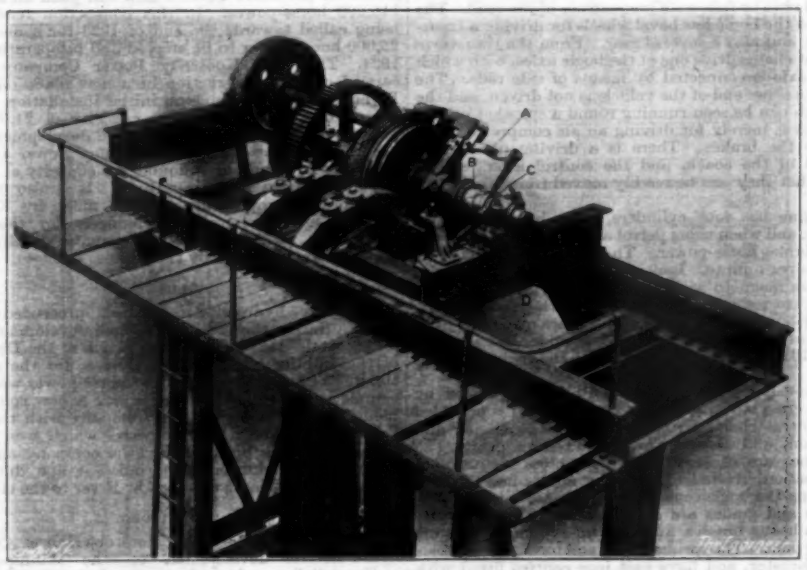


FIG. 3—NEW TYPE OF ACTUATING MECHANISM FOR BRETT DROP HAMMER

and they are secured in the desired position when it is attained by means of bolts and nuts, the former passing through elongated holes.

It will have been gathered from the foregoing that, in addition to remaining always parallel, the inwardly facing edges of the sliding strips close in towards one another, or are separated from one another, according to whether they are raised or lowered. Hence, an exceedingly accurate fit can be insured between the tup and the guides, so that any tendency to tilt when the hammer meets a resistance which is not central—as would be the case when working with a die not centrally placed—is prevented. Messrs. Brett assure us that this new construction of guide rod has entirely done away with all risk of fracture when working with multiple dies. It should be explained that the guides and tup are furnished with V projections and channels respectively, which fit accurately into one another.

In order that the hammer may adequately meet the new conditions, it has also been found necessary to strengthen it in another particular. Anvil blocks of drop hammers are usually made entirely of cast iron, and under ordinary stamping conditions—that is to say, with single-impression dies—they have proved, as has been said above, to be reasonably satisfactory. But cast iron is not really the right class of material for resisting bursting stresses, and breakages have occurred which have generally been attributed to an unusual stress set up between the guide rods or the poppets. Messrs. Brett considered it desirable to strengthen the anvil blocks of the new type of hammers in a manner corresponding with the increased strength of the guide rods. They accordingly make the top part of the anvil block of steel. There is, they consider, no objection to the base of the block being made of cast iron, since it has only got to withstand compression stresses. The base-block is, as will be seen from the accompanying illustrations, furnished with a dovetail to connect it to the other portion, since, for multiple-impression dies, that method of construction has several points of advantage.

Another feature of the new Brett hammers is the automatic lifter control with which they are fitted, and which is well shown in Figs. 1, 2, 3 and 4, of which the first represents a front view of the lower portion of one of the smaller sizes of drop hammers, Fig. 2 being a back view of a complete hammer of the same size, while Fig. 3 shows the lifting mechanism at the top of the hammer, and Fig. 4 is a drawing illustrating the arrangement of the control rope of the friction gear. The hammer illustrated is designed for either belt or motor drive, and, consequently, the lifter is of the friction-driven type, but instead of the control being by means of the ordinary cord and handle, necessitating the employment of a driver as well as a stamper, there is provided an automatic device by the aid of which the stamper controls the hammer himself by means of a foot treadle.

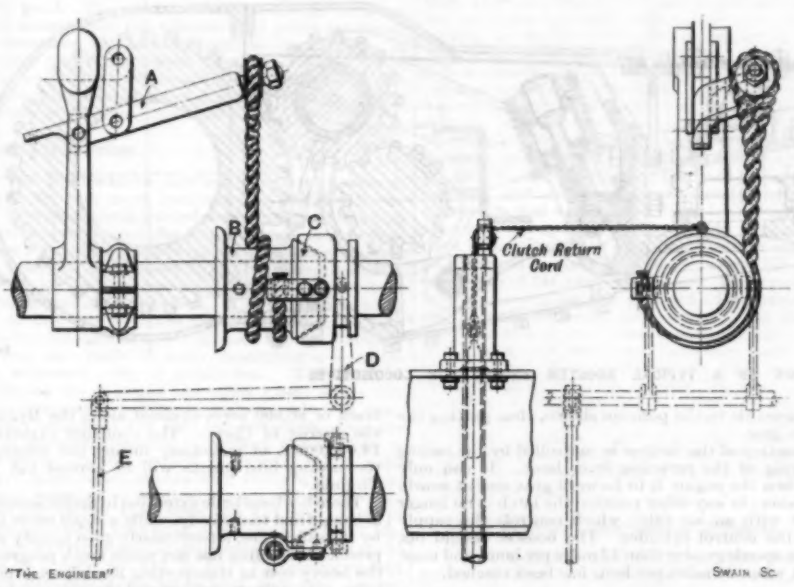


FIG. 4—ARRANGEMENT OF CLUTCH MECHANISM AND CONTROL ROPE OF FRICTION GEAR

The lifting mechanism has already been described in our columns, so that it need not be here referred to in detail. It need only be explained that it consists of multiple friction blocks, which engage in corresponding grooves machined in a steel drum. If and when the friction blocks are pressed into the grooves the tup of the hammer lifts, and when the pressure is removed the tup falls. For ordinary hand control a cord, furnished at its lower end with a handle, is attached to the control lever A—Fig. 3. The cord is coiled round the winch B, and the handle is arranged at a convenient height from the ground for the operator to grasp it. A very light pull is sufficient to cause the gear to operate.

In order to apply an automatic principle to this gear, a small friction collar or clutch C—Figs. 3 and 4—is introduced, and to it is attached one end of the control rope. This small collar or clutch really takes the place of the operator's pull. It is furnished with a cone-shaped internal recess, into which projects the cone-shaped end of the winch B.

The manner of automatically controlling the engaging and disengaging of this clutch is as follows:—The winch B is keyed to the shaft, but the clutch C is loose on it, so that, when the crank D is moved forward by a pull on the rod E, the clutch C becomes, for the time being, practically one with the winch B, and the control cord, since the end of it is attached to C, is pulled taut. The lever A immediately applies the friction blocks and the tup is raised. As a matter of fact, the rod E, which is also seen in Fig. 1, is of sufficient weight to keep the clutch C and the winch B constantly in engagement, and hence to operate the lifter, provided that no measures were taken to prevent its doing so. Why this does not occur will be made clear later.

The method of working is as follows:—Normally, the tup is held suspended, well above the work, by means of the catch H—Fig. 1—which is connected by a link with the foot treadle. When the tup is in this position, the weight of the rod E is sustained by a spring trigger F, so that there is no pull on the lever D—Fig. 4—and no engagement between the clutch C and the winch B. Consequently, the friction blocks are free in the grooves in the drum. When the stamper desires to work the hammer, he presses the treadle with his foot, thus disengaging the stop H from the tup and causing the latter to fall. At the moment of impact the spring trigger F is pushed back, because an inclined projection on the side of the tup comes into contact with it. The result is that the rod E falls by reason of its weight, which has the effect of bringing the clutch collar C into engagement with the winch B, with the consequence that the friction blocks are forced into their grooves and the tup is lifted, as already described. The tup then immediately ascends until a stud upon it comes into contact with the lever G—Fig. 1—which is attached to the rod E, with the result that the latter is lifted and the clutch C disengaged from the winch B, so that the friction blocks are released from their grooves and the tup again falls. The hammer will then continue to operate automatically, the sequence of operations just set out being repeated, until the stamper removes his foot from the treadle, when the catch H will again be projected—by means of the coiled spring to be seen in Fig. 1—into the path of the tup, so that the latter is held suspended. Although from the foregoing description the automatic motion may appear to be complicated, it is actually very fairly simple, for there are but few working parts, and we are assured by the makers that, in practice, it is most effective.

There is just one point remaining to be mentioned. It concerns a device, however, which is not peculiar to the new type of hammers, but which is now applied to all the Brett hammers, whether automatic or hand controlled. The device, which is illustrated in the right-hand drawing in Fig. 4, has for its object to ensure an absolutely non-clinging effect of the control rope when the tup is stationary. It is, as will be seen, quite simple, only consisting of a cord, which is taken over a wheel, and has attached to one of its ends a weight which can slide freely up and down inside a tube. The other end of the cord is attached to the control rope in such a way that when the tightening effect, which operates the friction blocks and causes the tup to be raised, is taken off, the weight at the end of the cord assists the uncoiling effect, which is due to the natural elasticity of the control rope, and pulls the latter quite free. The result, we are informed, is that the control rope never drags on the winch, so that wear and tear are minimised, and that the friction surfaces of the lifter are always quite free. Messrs. Brett claim that this is a very important point, since any tendency to drag on the part of the friction lifter, results in waste of power, and even if there be only a small amount of friction—not enough to cause the hammer to rise—between the friction blocks and the grooves, or between band brake and pulley—if the hammer embody that mechanism—it creates a quite appreciable amount of wear on the main friction members.

CONTRACTS.

WILLIAM BOBY AND CO., Limited, have been awarded a contract by the Admiralty for the supply of one of their Boby-Axed water-softening plants for a quantity of 100,000 gallons per day at a training establishment.

THE Vickers-Spearing Boiler Company, Limited, of 20, Kingsway, W.C. 2, has been awarded the contract for two 30,000 lb. Spearing type boilers and complete equipment for the Maidstone Corporation.

THE UNDERFEED STOKER COMPANY, Limited, of Aldwych House, Aldwych, London, W.C. 2, has recently received orders for thirty-five Travelling Grate Stokers, ten of them with arches; for five Underfeed Stokers; for two ash and coal conveyors, and for forced draught fronts to boilers.

THE contract for the construction of Section 8 of the new Welland Canal, connecting lake Erie and lake Ontario, has been awarded to A. W. Robertson, Limited, of Montreal. The contract amounts to 10,528,000 dollars. Section 8 comprises 3 miles at the western end of the canal. The new canal is expected to be completed in two years.

IMPORTANT contracts for the supply of machinery and engineering material for the London, Midland and Scottish Railway's reconstruction and improvement schemes, which are estimated to involve a total expenditure of £14,000,000, are now being allocated. We are informed, officially, that by January 22nd the orders, to a collective value of £348,077, had been definitely distributed among the following:—The Wellman Smith Owen Engineering Corporation, Limited, London; A. Herbert, Limited, Coventry; Hulse and Co., Limited, Manchester; The Columbus Machinery Company, London; Wm. Muir and Co., Limited, Manchester; J. Archdale and Co., Limited, Birmingham; Wm. Asquith (1920), Limited, Halifax; Kitchen and Wade, Halifax; Craven Bros., Limited, Stockport; The Sturtevant Engineering Company, Limited, London; S. Platt, Limited, Wednesbury; Wadkin and Co., Leicester; The Oliver Machinery Company, Manchester; Sir W. G. Armstrong, Whitworth and Co., Limited, Manchester; Webster and Bennett, Limited, Coventry; B. and S. Massey, Limited, Manchester; The Ewart Chainbelt Company, Limited, Derby; Ruston and Hornsby, Limited, Lincoln; Boyer, Peacock and Co., Limited, Manchester; The Birmingham Carriage and Wagon Company, Limited, Birmingham; C. Roberts and Co., Limited, Wakefield; Cammell Laird and Co., Limited, Nottingham; The Metropolitan Carriage and Wagon Company, Limited, Birmingham; The International Construction Company, Limited, London; Tangyes Limited, Birmingham; Crossley Bros., Limited, Manchester; The Selson Engineering Company, Limited, London; The Churchill Machine Tool Company, Limited, Manchester; The Vaughan Crane Company, Limited, Manchester; Smith and Coventry, Limited, Manchester; W. C. Holmes and Co., Limited, Huddersfield; Mather and Platt, Limited, Manchester; J. Holroyd and Co., Limited, Milnrow; J. Stirk and Sons, Limited, Halifax; The Brightside Foundry and Engineering Company, Limited, Birmingham; The General Electric Company, Limited, Birmingham; The Engineers Tool Supply Company, Halifax; Follows and Bate, Limited, Manchester; Haighs (Oldham), Limited, Oldham; F. Pollard and Co., Leicester; Thos. Robinson and Sons, Limited, Rochdale; Joshua Buckton and Co., Limited, Leeds; L. C. Steinle, London; The British Oxygen Company, London; J. Pickles and Sons, Hebden Bridge; Lancaster and Tonge, Limited, Manchester; J. Butler and Co., Halifax; Crow, Hamilton and Co., Glasgow; C. Churchill and Co., Limited, Glasgow; Geo. Russell and Co., Limited, Motherwell; Marshall, Fleming and Co., Limited, Motherwell; T. White and Sons, Paisley; A. Ransome and Co., Limited, Newark; Sir Wm. Arrol and Co., Limited, Glasgow; G. and A. Harvey, Limited, Glasgow; and Jas. Bennie and Sons, Govan, Glasgow.

CALENDARS, DIARIES, &c.

JOSEPH HENRY, Limited, Manor-road, Leeds.—Desk calendar with daily cards.

H. J. SKELTON and Co., Limited, London.—Wall calendar with daily tear-off sheets.

D.P. BATTERY COMPANY, Limited, Bakewell, Derbyshire.—Wall calendar with monthly tear-off sheets.

GEO. WALLER AND SON, Limited, Phœnix Ironworks, Stroud, Gloucester.—Wall calendar, with daily cards.

FRANK HOW AND CO., Trogon Wharf, 77–83, High-street, Stratford, E. 15.—Table petrol lighter in white metal.

SUN ENGRAVING COMPANY, Limited, Milford-lane, W.C. 2.—A calendar and diary, 1924. Illustrated in Sungravure.

INTERNATIONAL CONSTRUCTION COMPANY, Limited, 56, Kingsway, W.C. 2.—Wall calendar, monthly tear-off sheets.

W. MARTIN WINN, Limited, Station Works, Darlaston, South Staffordshire.—Wall calendar with daily tear-off sheets.

J. AND E. WRIGHT, Limited, Universe Rope Works, Birmingham.—Wall calendar with monthly tear-off sheets up to 1927.

BURTON, GRIFFITHS AND CO., Limited, 64–70, Vauxhall Bridge-road, S.W. 1.—Wall calendar with monthly tear-off sheets.

ASSOCIATED BRITISH MACHINE TOOL MAKERS, Limited, 17, Grosvenor-gardens, S.W. 1.—Wall calendar with monthly tear-off sheets.

WM. BROWN AND CO., Limited, 2, Bury-court, St. Mary Axe, E.C. 3.—Wall calendar with a very fine ink-photo reproduction. Monthly tear-off sheets.

URQUHART LINDSEY AND ROBERTSON ORCHAR, Limited, (associated with Fairbairn Lawson Combe Barbour, Limited), Dundee.—Wall calendar with monthly tear-off sheets.

LONDON, MIDLAND AND SCOTTISH RAILWAY, Euston Station, N.W. 1.—Copies of wall calendar with monthly tear-off sheets. A view of a train in standard colour of the railway is given.

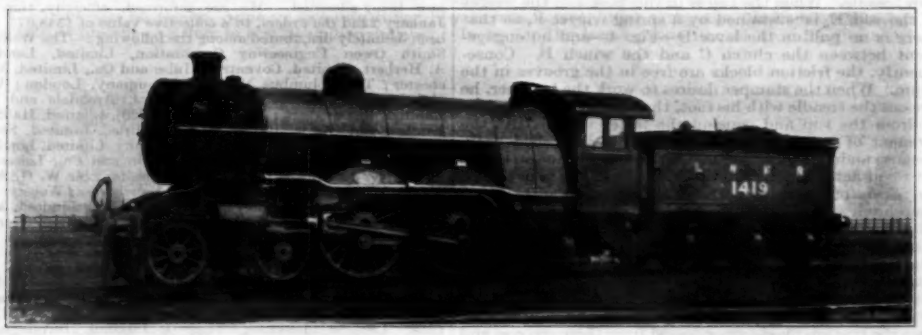
WELBECSON PRESS, Limited, 108–110, Clarendon-road, Holland Park, W. 11.—Desk calendar with monthly cards. Wall calendar with monthly tear-off sheets. Sporting picture in colours, "The End of a Perfect Day."

SASH CHAINS.—We have received from Chas. Wright, Limited, of Edgware, Middlesex, several samples of flat link chains specially manufactured for hanging window sashes. They are made of steel, rust-proofed, apparently, by a sherardising process, and have brass rivets with spun heads. The links are nice clean stampings, and there is very little back-lash or rattle in the chain. Several sizes are made, with breaking strains up to 1700 lb., while a similar type of chain in copper has a slightly lower strength.

INSTITUTION OF NAVAL ARCHITECTS.—The annual meetings of the Institution of Naval Architects will take place on Wednesday, April 9th, and the two following days, in the Lecture Hall of the Royal United Service Institution, Whitehall, W.C. 2. His Grace the Duke of Northumberland, C.B.E., M.V.O., President, will occupy the chair. The annual dinner will be given on Wednesday, April 9th, at 7.30 p.m., in the Grand Hall, Connaught Rooms, Great Queen-street, Kingsway, W.C. A Gold Medal will be awarded by the Council to any person, not being a member or associate member of Council, who shall at the forthcoming meetings read a paper which, in the judgment of the Council, is deemed to be of exceptional merit. The Council will also offer a Premium of books or instruments to the reader of any paper, not being a member or associate member of Council, which paper, in the judgment of the Council, merits this distinction. The Council of the Institution of Naval Architects has decided to hold a summer meeting in London on June 24th to 28th—in association with the Institution of Engineers and Shipbuilders in Scotland, and the North-East Coast Institution of Engineers and Shipbuilders—to be followed by visits to the Clyde and the North-East Coast districts, which members of the French and the Dutch Societies of Naval Architects have been invited to attend. The Council hopes in this way to return some of the hospitality which members enjoyed in France and Holland in 1922 and 1923 respectively.

LONDON & NORTH-EASTERN RAILWAY: BOOSTER LOCOMOTIVE

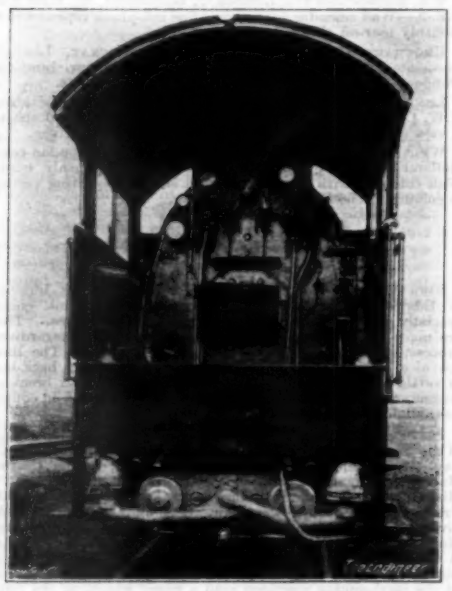
MR. H. N. GRESLEY, M. Inst. C.E., LONDON, ENGINEER



London & North-Eastern Railway: Booster Locomotive.

A FEW months ago Mr. Gresley fitted a booster made by the Franklin Railway Supply Company, of New York, to a two-cylinder "Atlantic." This engine is shown in the illustration above, but as some difficulty may be experienced in finding the booster, we may say at once that it is placed under the foot-plate and drives the trailing axle by gearing. The rear end view of the engine shows the position of the booster cylinders, which are each 10in. in diameter with a 12in. stroke. They develop approximately half the tractive effort of the main engine, which has 20in. by 24in. cylinders.

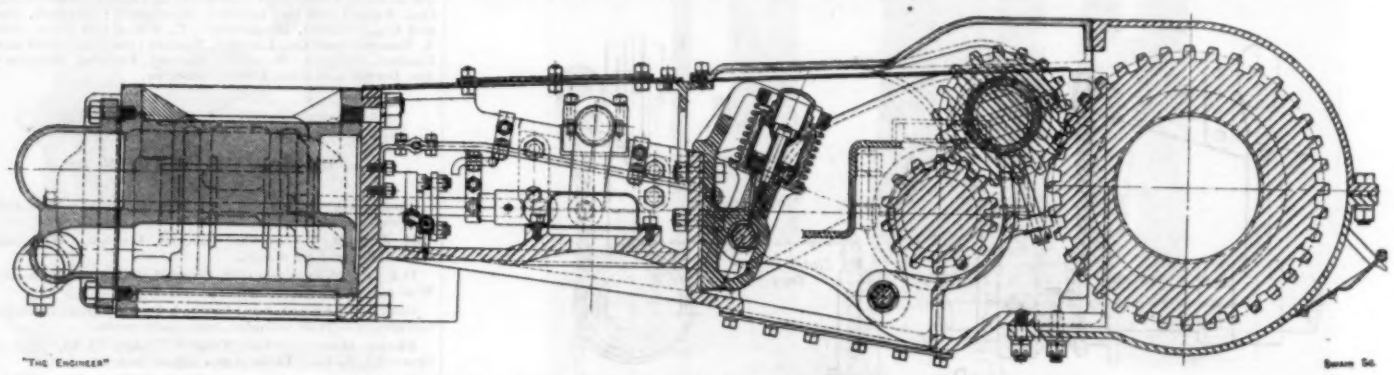
The booster engine is carried in a cast steel frame, which is supported by two bearings on the trailing axle and one on the cross member of the trailer truck. The last named is spherical, so that the booster engine can accommodate itself to the movements of the axle. A drawing of a typical booster engine is given herewith. It will be seen that a large gear wheel is fitted on the driving axle, that a pinion is mounted on the crank shaft, and that an idler wheel on a rocking arm connects or disconnects the two gears. The booster engine runs only in one direction and with a constant cut-off. The valve gear is, therefore, very simple, consisting of no more than a return crank driving a rocking shaft. The steam and exhaust pipes to the valve chest are best seen in the end view.



REAR VIEW OF BOOSTER ENGINE

The normal position of the idler gear is out of mesh with the wheel. It is held in that position by a spring, which is overcome by air pressure when the booster is needed. Looking at the longitudinal section it will be seen that the idler is carried on a frame which is fulcrumed below the crank shaft. To a third point on this frame is jointed an air cylinder, containing a piston which is rigidly attached to the bed-plate of the engine. A spring surrounds the cylinder and pushes it downwards, thus raising the idler, but if compressed air be admitted to the upper side of the cylinder the latter is forced upwards to the position shown, thus putting the booster in gear.

The operation of the booster is controlled by the raising and lowering of the reversing-lever latch. It can only be used when the engine is in forward gear and at nearly full admission; in any other position the latch is no longer in contact with an air valve which controls the supply of air to the control cylinder. The booster should not be cut in at speeds greater than 12 miles per hour, and must be cut-out when 21 miles per hour has been reached.



LONGITUDINAL SECTION OF A TYPICAL BOOSTER ENGINE FOR LOCOMOTIVES

Economic Conditions in Panama.

POLITICAL upheavals notwithstanding, Panama, both as a State and as a world waterway, prospered economically during the past year. While most countries have increased their commerce with the west coast of Latin-America owing to the Canal, the larger proportion has naturally gone to the United States. During the fiscal year British vessels carried 25.2 per cent, while those of the United States carried 56.5 per cent. of the total cargo passing through the waterway. The number of vessels increased from 1095 to 1994; commercial transits from 2736 to 3967; the net tonnage from 11,417,459 to 18,605,786 tons; cargo tonnage from 10,881,910 to 19,567,875 tons; and tolls from 11,197,832 to 17,508,199 dollars.

The remarkable growth in operations and income may be attributed chiefly to the wider movement in Californian petroleum, following the development of oilfields in the southern part of that State, and to Pacific coast lumber, which, previous to the Canal facilities, suffered so heavily under heavy freights that only a nominal amount of business could be carried on, mostly in specialities. Passage by waterway now renders it possible to transport lumber from the Pacific to the Atlantic at from one-third to one-half the charges formerly in force. In three years the lumber transport has almost trebled.

During the past year American trade with Ecuador increased 8 per cent., with Colombia 28 per cent., with Peru 37 per cent., and with Chile 56 per cent.; while Latin-American imports during the corresponding period gained 50 per cent., the total exports and imports aggregating a value of 1,060,220,000 dollars. The cargo moved between the West Coast and the United States expanded from 793,123 tons in 1922 to 2,954,523 tons in 1923. Working income increased from 7,690,777 to 17,691,844 dollars, yielding an excess of income over expenditure of 10,001,066 dollars. Against this operating profit was charged interest on 124,901,500 dollars, representing the value of the outstanding Canal bonds—held wholly by the United States Government—and the account taken for amortisation. The total cost of the Canal up to the end of June last was 384,686,658 dollars. Should the oil position not change for the worse, the Canal will, it is believed, show a healthy income, which will increase faster than the expenditure.

It is the policy of the Panama Government to improve internal communications and thus become less dependent upon Canal traffic. Convict labour for road construction is now being largely employed, batches of prisoners being kept constantly at work cutting trails through the forests, breaking rock, building culverts, &c. A small proportion of free labour is likewise employed. There exists a favourable opening for road-making machinery, as well as for engineers and other experts, in connection with contracts made for the construction of several important highways. When completed, these works will facilitate the transport of many additional products to market, which is now almost impossible. Agricultural production generally is making headway, almost every able-bodied man finding ready engagements at high wages. Money is plentiful and food is abundant.

Coffee growing in the mountains about Boquete has been started latterly, while stock raising in the rolling lower country between Boquete and David, now partly furnished with railway connections, is improving. It is proposed also to raise cacao, rubber, cocoanuts and ginger. Plantations have already been laid out by Jamaicans, most of whom are prospering. Special inducements are being offered to them and other settlers, while an agricultural and an animal husbandry school have recently been started. Experiments in raising cotton and different varieties of grain are being conducted under Government auspices.

The forest resources of Panama have as yet scarcely been touched. There are large numbers of commercial tropical woods awaiting exploitation, particularly on the lower slopes on the Pacific side in the Darien district. Mahogany, cocobolo, cedar, rosewood and other varieties grow in abundance, but the forests are situated at a considerable distance from the coast, and, pending further inland transport facilities, development of the timber trade must be slow and costly. In the meantime, however, a company has been incorporated to take over a timber track of 80,000 acres situated along the Byano River, in the district of Chepo. The company expects to cut up 18,000,000ft. of mahogany during the coming year, but the sawing into planks will be carried out in Norfolk, Virginia.

There has been little extension in manufactures. Tobacco is being tried tentatively, while a small trade is carried on by the salt mines, a particularly good quality of salt being produced. Mining has not made much progress, owing to the heavy cost of transporting machinery over the mountains, across rivers, gulches and through jungles. Railway development will serve to overcome this difficulty. The Government has meantime granted a number of concessions for the working of copper, silver and zinc deposits, while a fair amount of prospecting is in progress.

GOVERNMENT PATENT USERS.

THE patent law in this country provides that a patent shall have the like effect against the Crown as against a subject, but it does not settle how the Crown is to be sued. In practice, inventions are often utilised by Government Departments, and the Acts of 1907 and 1919 taken together determine the cases in which some toll must be paid to the patentee and those where inventions may freely be used for the services of the Crown. Where it is sought to obtain a decision in an action against the Government, the usual course is for the Department concerned to appoint a nominee who acts as defendant. Cases of this character are not common, for which reason two that have been recently reported in the Official Patent Reports are of interest.

The first action dealt with several patents relating to rifle grenades. The action was brought against the nominee of the Government for alleged infringement. As a defence it was pleaded that the patents were invalid, both on the ground of prior user and also lack of patentable subject-matter. Three patents were ultimately held invalid by the Court of First Instance, though its decision is subject to appeal.

As to the first patent, the Court found that the main patent was anticipated. As to the second, it was for an old type of device. The third patent it considered valid and infringed, because any disclosure in the only specification relating to rifle grenades cited against the patent would be more likely to lead anyone away from the plaintiffs' invention, and thus emphasise the merit of the latter. As regards the previous specification, which related to shells, the material differences in the conditions of shells and grenades in relation to air pressure was so great that there was hardly any analogy between the two classes of projectiles. The fourth patent was found to be invalid, because it dealt with a device which must be considered obvious.

In the second action the letters patent in question

relates to diaphragm horns and like sounding instruments. This action was brought against a Government nominee for a declaration of validity and infringement. Subject to appeal, the learned judge held that infringement was proved, but the patent was invalid for want of subject-matter.

The Government nominee at the trial relied on a particular prior specification, which indeed was specifically referred to in the plaintiffs' patent, and contended that coupling that prior specification with common knowledge there was no invention made by the plaintiff. The Court found that after the fact had been disclosed that one could have an air pressure chamber in which the inlet and outlet of air operated on one side of a rib or as soon as it was appreciated that a sound-producing instrument could be made in which the pressures were all on one side of the diaphragm, the remainder of the matter claimed by the patentee became obvious, leaving nothing to invent.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

Moderate Activity.

THE iron and steel and engineering industries of the Midlands and Staffordshire maintain moderate activity. A fair amount of business has been booked, and keeps works going, but new business is not forthcoming as freely as could be desired, and is of small dimensions. This area was less affected than most others by the railway strike, owing to its extensive canal system. There was no great dislocation of industry, though supplies of raw material were secured only with difficulty. However, the strike has left no legible mark on the Birmingham iron market, and business on 'Change to-day—Thursday—was fairly good. The market is still under the influence of foreign competition, but whereas steel prices are giving way, ironmasters continue successfully their efforts to secure higher prices. This week merchant iron has firmed up to last week's highest quotation, notwithstanding the fact that considerable tonnages of Belgian iron have come into the district at a very low figure.

Finished Iron Prices.

The Staffordshire finished iron works, though they could do with more business, are fairly well employed. Moreover, the increased consumptive demand for railway development and the improvement in the shipyards have considerably improved the iron trade outlook. Encouragement is also drawn from the improvement in exports. Under the new impetus, selling prices have been brought to a more economic level. If the turnover should continue to increase as it has increased during the past few months, the prices now obtained would probably show a very fair profit in most departments, notwithstanding enhanced cost of production. This week a further firming up of prices has taken place, and a fair amount of business is passing in higher grade iron bars. Marked bars remain at £14 10s., but enhanced prices are quoted for other descriptions of finished iron. There is some contrarity in the market, however. While mills which have large commitments with the wagon builders and various branches of engineering are advancing their quotations for Crown bars from the £12 10s. level, at which they have stood for a long time, towards the £12 15s. mark, in a few exceptional circumstances Crown iron could this week be bought for £12 7s. 6d. The corresponding product of Lancashire has for a week past been quoted £12 15s., and many makers this week quote prices ranging up to £13 for export, f.o.b. There has been a sharp appreciation in fencing iron. Makers of nut and bolt bars generally realised the advance for which many of them tried successfully a week ago. Until lately the price charged, both by Staffordshire and Lancashire bar makers, was £11, but three weeks ago Lancashire iron advanced to £11 10s., and makers have now declared a further increase of 15s. per ton, making the price £12 5s. Staffordshire values have appreciated to £11 10s., but makers do not yet see their way to follow the lead of Lancashire. With the cost of carriage against them, it is hopeless for Lancashire mills to compete with mills in this district for the Darlaston nut and bolt business. It is generally agreed that the higher prices are called for, having regard to the higher cost of production, but foreign competition has become more formidable than ever, and Staffordshire makers find it difficult enough to get business at present prices in face of the Belgian quotation of £8 10s. delivered. Fairly heavy lots of continental material are coming into the district, and with native prices rising, an increasing quantity must be looked for.

Galvanised Sheets.

Galvanised sheets are still a slow market at the recently reduced rate of £18 5s. for 24 gauge corrugated, both for home and export. Most mills, however, have good reserves of orders, and have no cause for worry. The demand for black sheets has improved considerably, and is at the moment one of the most hopeful departments. The tin-plate trade continues very well employed, and order books are still bulky.

Ironworkers' Wages.

The certificate of the Midland Iron and Steel Wages Board recently issued with regard to sales and prices during November and December last shows a substantial increase in the former, but prices have not increased sufficiently to affect ironworkers' wages, which, accordingly, will remain unchanged at 55 per cent. above the base rate of 13s. 6d. until April.

Severe Competition in Steel.

The severity of continental competition in the steel trades is but slightly relaxed, and though steel works have still moderate reserves of business, considerable anxiety as to the future exists. Steelmasters hereabouts anticipate a trying time during the next few months. This week some Belgian exporters have advanced their prices, being pretty well booked, but the movement was not general. Speaking generally, quotations for mild steel billets were round about £6 10s., in one case £7 delivered was asked. Though associated firms at home are asking up to £8 10s., some large firms outside the Association quote £8. Belgian blooms can be bought for less than £6 10s., while small bars are quoted £7 12s. 6d. to £7 15s. Home makers who want £10 5s. to £10 15s. are placed under a severe handicap. Outside the development schemes which are in progress, there is not much inquiry for structural steel. Plates ¼in. and under are in strong request at prices ranging from £10 5s. to £11. Angles and joists are firm at £10 and tees at £11, though continental joists can be bought advantageously. Staffordshire hoops are steady at £12 at works. Makers of wire rods want £11 10s. for ordinary qualities, and 15s. to 20s. extra for dead soft. The continental price for the former is £9 12s. 6d. Steel strip for tube making can be had in some quarters for £10 15s.

Scrap.

Prices of steel scrap are fairly stable at £4 15s. per ton, having recovered a little from the slump of a few weeks ago. This line is subject to heavy importations from the Continent, and sellers have to advance prices cautiously.

Smelters' Difficult Position.

Though pig iron is in fairly good demand, smelters find themselves in a difficult position. The shortage of coke is causing them much trouble, and the price element is adding its weight. Production costs are advancing, yet they find it impossible to get higher prices for their product. Inability to get fuel at a reasonable figure is keeping several Midland furnaces out of action, which would be restarted under more favourable circumstances. Blast-furnace owners in Northamptonshire and Derbyshire who were forced to suspend production during the railway strike have now made a fresh start, but others are waiting for future developments respecting coke prices. They want to be assured that if they restart they will be able to arrange for coke supplies at a cost which will make pig iron production profitable. Although an agreement was reached with the South Yorkshire suppliers to maintain the price at 24s. per ton at ovens until the end of March, users who failed to cover themselves with forward contracts have for weeks past been asked to pay increased prices. Those who seek supplies to-day are asked 30s. 6d. per ton, and a case has been mentioned in which an emergency deal was made at 35s. a ton. Pig iron smelters, therefore, are not disposed to commit themselves. Moreover, it is suggested in some quarters that coke prices will be advanced at the end of March above the present contract basis of 24s. per ton at ovens. The precarious margin between present pig iron cost and selling price is occasioning the trade generally much concern, and the possibility of an increase in production costs adds gloom to the outlook. Sales of Midland irons have been made this week at recent prices. For Derbyshire No. 3 foundry £4 17s. 6d. has been asked, but it is claimed that business has rarely been done at above £4 16s. 6d. Forge qualities command round about £4 10s. Northamptonshire foundry sold at £4 13s. 6d. upwards, and forge at £4 7s. 6d. at furnaces. Belgian pig iron in small quantities has found its way into this district, but most users prefer Midland irons, costing a few shillings more.

Lord Dudley's Ironworks and Collieries.

The Earl of Dudley's Round Oak Works, Limited, announces that it has acquired from the Earl of Dudley the whole of the share capital in the Earl of Dudley's Baggeridge Colliery, Limited, the Himley Collieries, and the following concerns which hitherto have been carried on by the Earl as separate undertakings, viz.:—The Level New Blast Furnaces, the Pensnett Railway, the Pensnett Canal, Castle Mill Engineering Works, Coneygre Foundry, Wren's Nest Limestone Works. The consolidation of these trade undertakings in one company places the Round Oak Company in a most favourable position for the economic production of its various manufactures.

Important Contracts for Midland Firms.

Satisfaction was expressed when it became known in Birmingham this week that in connection with railway reconstruction schemes, important contracts had been placed in the hands of Midland firms. Fifty all-steel hopper wagons, specially designed for the conveyance of iron ore, are to be constructed by each of the following Midland firms:—The Birmingham Railway Carriage and Wagon Company, Limited, the Metropolitan Carriage, Wagon, and Finance Company, Limited, of Saltley, Birmingham, and Cammell Laird and Co., Limited, Nottingham. The Wellman Smith Owen Engineering Corporation, Limited, of Willenhall, Staffordshire, have been awarded a contract for additional steel works plant for the London, Midland and Scottish Railway Company depôt at Crewe, comprising four open-hearth furnaces, 250 tons capacity and 275 tons capacity, together with all chargers, ladles, cranes and other auxiliary machinery, and the structural work required in connection with the new buildings. The contract is valued at approximately £150,000. Amongst the engineering firms who have received contracts from the London, Midland and Scottish Railway in connection with their £14,000,000 reconstruction scheme are J. Archdale and Co., Birmingham Carriage and Wagon Company, Tangyes Limited, Metropolitan Carriage and Wagon Company, Brightside Foundry Company, and the General Electric Company.

Increase in Unemployment.

Unfortunately this week I have to record a large increase in the number of unemployed persons in the Midlands area, but this is attributed to the effects of the railway strike, and next week's returns are expected to show a correspondingly large falling off. Last week the number of workless in the area was 155,083. That figure has been increased for the week ended January 28th by more than 5000, the latest returns giving the number of unemployed persons as 160,298. To this total, the Birmingham area contributes 38,036, Bilston is responsible for 3887, Coventry 2736, Cradley Heath 5921, Dudley 4803, Northampton 2203, Oldbury 1903, Smethwick 4785, Stourbridge and Brierley Hill 3681, Walsall 6098, West Bromwich 2983, and Wolverhampton 7862.

LANCASHIRE.

(From our own Correspondents.)

MANCHESTER.

General Outlook.

THERE is still a very languid feeling in the iron and metal markets here, in spite of the relief from the effects of the recent railway stoppage. Traffic is in order again this week, but new business is lacking; and although most sellers seem confident that prices cannot recede, consumers are by no means so satisfied on this point. It is, in fact, the old question whether prices are to be controlled by costs of production or by demand. If the former, of course, sellers are right, because there is no present prospect of economising in the cost of producing iron and steel, and, indeed, the probabilities are quite the other way. All those fond hopes of getting wages and general industrial conditions back to a pre-war level must be shattered by this time, and we seem now to have reached a point where wages are likely to rise. But consumers of iron and steel do not believe that producers will be able to raise selling prices in accordance with any increase in costs of production.

Metals.

The market for copper, after showing some inclination to advance, sufficient apparently to give manufacturers an excuse for restoring the price of sheets to £95 per ton, has relapsed again, and is rather weaker and in an uncertain condition. The great increase in the output of South American copper has come at a rather unfortunate time for the market, for what was required was a slowing down of output until the engineering trades of the world had recovered and were in a position to take normal quantities. One hears still of an agitation in the "Lake" copper district for a protective duty against South American copper, and the engineering industry here may perhaps hope that it will succeed, for if so, North American consumers will have to pay more and their power of competing in engineering work will be correspondingly weakened. The recent movements in copper prices seem to be connected with exchange movements, and do not appear to reflect any adverse influence on real market conditions. The demand for copper from the electrical trades, and especially from cable makers, has been very good. Tin has kept moderately steady for some time. Of course, a fluctuation of £5 in tin barely corresponds with a fluctuation of £1 in copper or 10s. in lead and spelter. There is some speculation as to whether the actual production of new metal is now increasing. Some of the reports suggest that this is the case, and they are used as an argument that tin prices should now be at the top. That is very difficult to say, but the consumption of tin is still increasing, and one is inclined to take rather a favourable view of the market in spite of the high price. Lead and spelter have again been very strong, and a further advance in prices has taken place. The outlook for these metals seems good.

Pig Iron.

The local demand for foundry iron does not seem to improve at all. Of course, it is well known that a great many Lancashire foundries bought as much iron as they needed up to the end of February before the turn of the year—and in some cases perhaps a little more—and in the absence of any special activity in the demand for castings they are not likely to be in the market yet. No doubt, much of this buying was in anticipation of much better business than has yet developed, for the expectation of a revival all round was very strong during the last two months of the year, and the present stagnation is all the more disconcerting. Makers of Midland pig iron are, however, content to wait for further business, having enough on the books to keep the furnaces going for a month or two. They still quote 95s. at the furnaces for No. 3 iron, and one or two of them ask 96s. and 96s. 6d.; but the small business now being done is almost always at the lower price. Some North Lincolnshire No. 3 iron is offering, but this costs about 1s. 6d. more than Derbyshire when delivered here. Scotch and Cleveland irons remain rather weak, but there is still no probability of Cleveland being able to compete with Derbyshire, except in the extreme north of the county.

Steel.

The local market for finished steel is, if anything, quieter, and certainly in a weaker position than that of pig iron. It is feeling more seriously the effect of the low continental prices, and buyers here hesitate a good deal before giving orders for sectional steel at the Association prices. It is possible that those observers are right who have been saying lately that the steel associations have reverted to controlled prices too soon. It seems to be a general rule that these controls can be useful only, or mainly, when trade is good. The nominal price of sections here is still £10 per ton, but there are rumours of lower quotations. Of course, these may be given by merchants, and may not mean that the control is weakening.

Scrap.

Steel melting scrap is still rather neglected, and there is not much being done yet in cast scrap iron, but for heavy wrought scrap there is a fair demand at £4 17s. 6d. to £5 per ton. Ironfounders can buy all the cast scrap they want at 90s., and one does hear that in some cases dealers have accepted less; but there are sure to be some weak holders who do not like to miss the chance

of selling, especially as the selling of scrap is now a far more difficult matter than the buying.

Institution of Mechanical Engineers.

Thursday, the 31st ult., was a red-letter day with the graduates and students of the North-Western Section of the Institution of Mechanical Engineers. It is only very rarely that the younger men of the Institution have the opportunity of "sitting at the feet" of such eminent men in their profession as on this occasion. Sir John Dewrance came down to present the Institution's prizes which have been gained by local students and graduates. The prize for the best paper during the session was won by Mr. F. C. Dollin and the second prize by Mr. R. C. Bond; while Messrs. G. Parker and J. A. Henson were presented with prizes for the best papers at the April and October examinations. The new smoke-room at the Engineers' Club was filled to its utmost capacity by corporate members and graduates, and the speeches were of a high order. Sir John Dewrance, after he had presented the prizes, in his remarks referred to the aims of the Institution and its various functions, and emphasised the Council's desire to encourage the provincial sections. He concluded his address by urging the necessity of carrying on research work. Sir John's address was followed by that of Sir Holberry Mensforth, on "Works Management as a Career," which was given in his customary style, with sound advice based on long practical experience, interspersed with touches of humour. Sir Henry Fowler also spoke on the same subject, and referred in complimentary terms to Sir Holberry's work at Woolwich Arsenal. A vote of thanks to Sir Holberry was afterwards proposed by two of the graduates in very effective little speeches. Altogether, the evening's proceedings were a great success, and reflect great credit upon all concerned.

Manchester Street Traffic Problem.

The congestion of the Manchester streets due to the great increase of wheeled traffic is a subject which has been uppermost in the minds of the City Council for some time, and is one which sooner or later will have to be dealt with on drastic lines. The problem is complicated by conditions which are difficult to cope with, such as narrow thoroughfares, the employment of slow-moving horse-drawn lorries, which are frequently allowed to stand for long periods while loading and discharging merchandise, a very frequent tramway service, and the ever-increasing motor traffic. There are many different views as to the best means of remedying the existing conditions, including street widening and the exclusion of the tramcars from the centre of the city, but the latest scheme which has been propounded by Mr. E. L. Leeming, engineer and surveyor of the Barton-upon-Irwell Rural District Council, is a particularly bold conception. It is intended chiefly to remedy the congestion of the tramway services of both the City of Manchester and the Borough of Salford. He proposes in the first place to short-circuit the Irwell by the construction of a culvert from the point at which that river approaches Chapel-street, Salford, to a point near Regent Bridge, leaving the river bed dry from Regent Bridge to Exchange Station, thence north by Great Ducie-street and westward toward Chapel-street, Salford. The proposal is to construct a roadway, three tramway tracks, and a canal for barges, along the river bed, from which six underground tramway routes would run under existing roads. By this means the author of the scheme expects to remove the congestion due to the tramways along the most important thoroughfares, Deansgate, Portland-street, Mosley-street, Market-street, Piccadilly, London-road, Regent-road, and Gt. Ducie-street. Mr. Leeming estimates that the subterranean tramways would be about 20ft. below the street level. As regards expense he puts the cost of the river diversion and paving of the river bed at between £300,000 and £400,000, and the subways at £250,000 and £300,000 per mile. The proposed culvert would be about half a-mile long and the length of river bed dried up nearly three miles. Whether or not such a scheme is practicable on account of existing subterranean works will have to be decided by the respective corporations.

BARROW-IN-FURNESS.

Hematite.

There is no new feature in the hematite pig iron trade. The improvement which was expected when the New Year came in has not been noticeable yet; in fact, there is quite a feeling of uncertainty about business. This is very disappointing and contrary to general expectations. Various reasons are given for this suspension, amongst others the recent strike, and the advent of Labour to Downing-street. The amount of business with the Midlands is the best, and that is not great, and such orders as are being placed are for immediate requirements. There is no inclination to place orders for forward delivery. The Scotch business is small, although it is known that requirements are considerable. The amount of business being done in special qualities is not great at the moment, but a better demand for this low phosphorus iron is expected. With the present number of furnaces in blast, there is no difficulty in supplying all requirements; in fact, some has gone into stock. The charcoal iron furnace is still working at Backbarrow.

Iron Ore.

The iron ore trade is dull, and there are a few mines doing practically nothing. This is not to be wondered at, considering the restricted number of furnaces in blast. The prospect of a revival of the trade is on the dull side. There is not much going out of the district. Trade in foreign ore is poor, and there is no likelihood of an improvement for some time to come.

Steel.

The steel trade remains about the same. There are orders still in the market, but competition is keen, and the continental makers are cutting in and making themselves felt now. The Barrow rail mills have orders. Foundries are better situated. The hoop and section mills are better placed than are the other departments.

SHEFFIELD.

(From our own Correspondent.)

Some Disquieting Features.

ALTHOUGH the heavy steel trades continue to enjoy a good measure of employment, the outlook is less bright than it was. The difficulties of the labour position—the railway strike and the danger of other strikes—constitute a disturbing factor, and a distinct drop in the buying of raw and semi-manufactured material is reported. A revival of continental competition is affecting the demand for rolled steel of the lower qualities. Belgium and France are quoting prices so low as to put British material out of the market to a considerable extent. Owing to this, home producers are having to offer rates which do not cover costs, and a good deal of steel is being made on an unremunerative basis. A good deal of disquiet is being caused by reports as to the Government intentions in the matter of naval work. It is earnestly hoped that the statements as to reducing work on the Singapore base and on the light cruiser programme may prove to be ill-founded. Sheffield has been building high hopes on the expected activities in these directions, especially in connection with the cruisers, and any serious interference with them would be a serious blow. Sir Arthur Balfour, President of the Associated Chambers of Commerce, in a lecture which he delivered in Sheffield last week, described the Singapore base as merely a question of ordinary insurance, in order to protect our trade; and urged that it would be folly to save money on light cruisers at the expense of the adequate protection of our trade routes.

Finished Trades Improving.

The lighter side of the steel trade has been slow in recovering the great amount of ground lost during the slump, but it is now making continued progress. The position of crucible steel is yet far from satisfactory, but there is movement in the right direction. Good orders for the best tool steels are being booked by some of the largest makers, but most other firms report that business is irregular and not of great bulk. The departments supplying the motor industry with stampings and other parts, in special steel, continue busy. It is on the tool side, however, that the improvement is most noticeable. More activity in the engineering shops is indicated by the state of the tool makers' order books. There are increasing sales of steel castings, files, saws and tools, while for tools used in excavating work the demand is excellent. The local trades in stove grates, light castings, and edge tools, stand to gain by the acceleration of house building which is expected in the near future.

The Cutlery Trade.

The condition of this staple branch of Sheffield industry shows no improvement, but rather a decline. Ever since the Christmas holidays the demand has been on the slow side, and it is an exceptional experience to find a satisfactory order book. The trade in stainless table cutlery shows a considerable falling off as compared with the state of a year ago. In spring cutlery and scissors, however, there is rather more doing, and the same may be said of razors, although that section is still very depressed. The dispute between the table and butcher blade grinders and their employers over the question of trough rents continues, and has extended. A further 400 men came out on Saturday, making a total of 700 on strike. Machine grinding is not affected by the dispute. Full advantage is being taken of the mechanical grinding plants available in the city, and it is reported that steps are being taken to procure more machines as quickly as possible. The trough rent difficulty does not affect the whole of the hand-grinding trade, as some firms have made satisfactory agreements with their employees.

Silver and Electro-plate.

There is little change to report with regard to these departments, which, on the whole, are but moderately employed. January is always a quiet month, and the fact that things looked up a little last week-end encourages the hope that February may be better. It is in the more expensive sections of the trade, for silver and plated hollow-ware, that conditions are least satisfactory, and the present position appears to be somewhat worse than that of twelve months ago. There is work on hand sufficient to last some months in executing large contracts for spoons, forks and small plated goods, cased and otherwise, for the coupon trade. A very extensive business is also being done in the production of low-priced tea knives, "apostle" spoons, and other cheap lines.

Lincoln Director on Russian Trade.

Will the new *rapprochement* between the British and Russian Governments have a good effect in stimulating trade between the two countries? Everybody is hoping that it will, and none more than the Sheffield makers of saws, tools, reaper sections and other light products, which used in the old days to be sent over in millions. Mr. G. R. Sharpney, managing director of Ruston and Hornsby, Limited, Lincoln, who recently visited Russia, made an interesting speech on this subject a few days ago to the Lincoln Chamber of Commerce. He expressed the opinion that it was only possible to do a great deal of business with Russia on credit. There was political insecurity, and the foundation of everything was to get the political situation put right. In the meantime, the greatest possible assistance could be rendered if our Government granted reasonable facilities for Russians having orders to come to England to place them. That was, he said, the greatest difficulty traders were now experiencing. Lincoln had built up her business by supplying Russia and other countries with machinery, and delivering it to buyers in villages or country places on the spot, and that had been done only through a large body of agents. If the Government would only sweep away all the regulations which militated against people coming into this country to trade, business men could work out their own salvation. The Chamber passed a resolution asking the Government to take such steps as would enable trade between this country and Russia to be developed and expanded as rapidly as possible, and also to make adequate provision for the recognition of Russian pre-war indebtedness and the adjustment of the claims of British nationals in Russia.

Grimsby and Boston Schemes.

Grimsby Town Council has road and housing schemes on hand, which will involve a total estimated expenditure of £67,000. The largest project is for the widening and improvement of one of the main approaches to the town, bordering on the Corporation's housing site. The cost of this will be £43,000. The Ministry of Transport is being asked for a grant of 50 per cent. of the money, and it is proposed to borrow the balance. At Nunsthorpe, the garden city site, it is proposed to expend £22,200 on the construction of roads and sewers. The Boston Rural Council has decided to contribute £1700 to the rebuilding of Mainridge Bridge, over the Maud Foster Drain, between Skirbeck and Boston. The total cost is estimated at £4000. The Ministry of Transport is being asked for half of this, and the Holland County Council, Boston Corporation, and Witham Commissioners for smaller contributions.

Scarborough Pier.

It is proposed to extend and repair the West Pier at Scarborough, at a cost of £3830, and, subject to the necessary financial arrangement being made with the Corporation, the Harbour Commissioners have decided to put the work in hand immediately. The pier is to be made 6ft. wider along the side of that portion on which the fish market is held. By this means the pier will be considerably strengthened, and more room provided for handling fish landings. It is hoped to be able to carry out the work before the arrival of the herring season in July. It is desired to take in hand the deepening of the harbour at an early date. Efforts are still being made to secure State aid for the scheme.

NORTH OF ENGLAND.

(From our own Correspondent.)

Industrial Unrest and Foreign Competition.

THE industrial position generally in the North of England has once more assumed an uncertain aspect, and is again beset with many disturbing influences. The confident hopes at the beginning of the year of a revival in the iron and steel trades are still unrealised. It is true that the hopes were never on a solid foundation, but there seemed to be on the horizon a promise of continued expansion in demand, and a gradual approach to more nearly normal output. Prospects, however, have quickly changed. Threats of more industrial unrest have shaken the confidence of buyers, and another menace to the industry is the severe competition to which producers have been exposed through the sudden fall of the franc, which has given French manufacturers a big advantage. It is, of course, merely temporary, but it has for the time being shut out Cleveland pig iron from most of the continental markets. Even the home market has been invaded, and in the North of England French pig iron is being sold to steelmakers at about 10s. 6d. per ton less than Cleveland pig iron. The position, no doubt, will be adjusted in time, but the abnormal situation has created fears that some of the furnaces in the Cleveland district may have to be put out of operation.

Iron and Steel Exports.

The shipments of pig iron from the Cleveland district during January showed a marked increase over those for the previous month, but they were chiefly made against old contracts, for business on export account in the first month of the year was on a very restricted scale. The total for January was 41,270 tons, as compared with 23,948 tons in December. Italy was the largest customer, with 7465 tons, the largest quantity shipped to that country from Cleveland for nearly twelve months. Although a keen competitor, Belgium took 4929 tons, 3430 tons were sent to the United States, 3050 tons to Denmark and 1853 tons to Germany. The volume of manufactured iron and steel declined from 62,892 tons in December to 54,529 tons in January. The decline is not, of course, serious, and may be accounted for by the holiday interruptions. Still, it is increasingly difficult to secure export orders. The principal customers were:—India, 15,570 tons; Japan, 5241 tons; Cape of Good Hope, 4006 tons; and Egypt, 3258 tons.

Cleveland Iron Trade.

The contraction in business and the effect of foreign competition has produced a certain weakness in the prices of Cleveland pig iron. There are still considerable quantities of French iron being offered at prices far below anything that Cleveland makers can consider. The broad effect is that although there is a steady consumption in the local steel works, the output of pig iron exceeds the demand, and makers are cutting prices in order to attract business. They have no great margin to work with, as costs of production are high, but most makers are now willing to accept 98s. for No. 3 G.M.B. Cleveland pig iron. No. 1 has fallen to 100s., No. 4 foundry to 96s., and No. 4 forge to 95s.

Hematite Pig Iron.

A weaker tone is also reported in the East Coast hematite pig iron trade. Some of the makers still ask 102s. per ton for mixed numbers, but supplies are easily obtainable at 101s. 6d., and buyers are not prepared to pay more. No. 1 stands at 1s. premium.

Ironmaking Materials.

The foreign ore trade is still idle, the outlook being too uncertain for buyers to operate. Prices, however, are maintained, best Rubio being 24s. per ton c.i.f.

Tees. Coke is weaker. The Durham makers are asking 36s. per ton for good medium furnace qualities, delivered at the works, but consumers report sales at lower figures.

Manufactured Iron and Steel.

Little change is reported in the position of affairs of the manufactured iron and steel trade. The gradually increasing activity of the shipbuilding industry is reflected in an improved flow of specifications to the steel works, but buyers still hesitate about placing new business Confidence is lacking, and consequently buying is again on a hand-to-mouth basis. Makers are still cutting for export orders, but adhere to agreed prices for home deliveries.

The Coal Trade.

A firm tone characterises the Northern coal trade. The scarcity of coal supplies at many centres on the Continent, and the effects of the threatened dockers' strike at home ports is causing consumers to use every possible means to expedite shipments, and all coal fitters state that they are pulled out for prompt supplies, and the general inquiry, especially from the Continent, is exceptionally good for this period of the year. Demands under contracts and heavy bookings on the open market have cleared off supplies for early shipment, and the few parcels offering realise high prices. The prospects for the second half of the month are good, and orders appear to be more numerous than supplies obtainable. All descriptions of steam and gas coals are firmly quoted, some grades showing a distinct rise in value. There is a moderate pressure for coke, but supplies are ample and prices show no change.

Iron and Steel Imports.

Statistics presented at this week's meeting of the Tees Conservancy Commission showed that the imports to the Tees from abroad and coastwise of crude sheet bars, billets, blooms, slabs, &c., during the past three months totalled 11,173 tons, as compared with 19,763 tons for the corresponding period a year ago. Pig iron imports amounted to 1691 tons, as against 2015 tons, and plates, bars, angles, rails, joists, &c., to 3147 tons, as compared with 3312 tons.

SCOTLAND.

(From our own Correspondent.)

Increased Clyde Output.

THE figures for January indicating tonnage launched on the Clyde are well up to the average for the best years since 1904. Nine vessels, of 36,917 tons aggregate, were launched, compared with four, of 15,695 tons, in the same month last year. It is believed that costs of construction are not likely to fall further, for some time at least; in fact, indications have been all in the other direction. Owners, therefore, have been more disposed to make necessary additions to their fleets, and during the past two to three months an encouraging number of new keels have been laid down. Chief amongst the vessels launched were the following:—Kemmerdine, passenger and cargo, 7833 tons, by Messrs. Denny, Dumbarton; Dolius, t.s. motor ship, 5930 tons, by Scott's Shipbuilding and Engineering Company, Greenock, for the Holt Line; Gretaston, cargo, 5000 tons, by Messrs. Duncan and Co., Port-Glasgow. Two steamers of over 4000 tons for British owners were also included, and one of almost 2000 tons for the Matthews Steamship Company, Limited, Toronto. Near the close of 1923 a number of fresh contracts were reported, and others followed during last month. The present situation is very encouraging. Included in the new contracts are vessels of 11,500, 9000, 5500 tons and smaller dimensions. Employment at the yards and engineering shops has improved, and will become still better as the new work advances.

Steel and Iron—Quiet Markets.

The slump in buying which has been apparent since the beginning of the year is still most noticeable. Small orders are certainly coming along, but practically nothing of an important nature has been reported. Steelmakers who expected to benefit largely from shipbuilding and railway specifications still await the expected rush of business, and the capacity of the mills is far from being taxed. Buyers may be on the lookout for cheaper prices, but over and over again it has been stated that values are not likely to fall further at present. Industrial unrest has, of course, to be reckoned with, and perhaps with a quiet period probable, a spurt in buying would take place. Meantime, steel plates, sectional material, and sheets could all be doing with new business. The last-named has experienced a steady turnover for a considerable period, but of late both home and export demands have slackened. The bar iron mills are in a similar position. Plants are only moderately active, and fresh business is scarce. Consumers are evidently well covered meantime, and are not disposed to anticipate requirements far ahead. Some fair inquiries for re-rolled steel are in circulation, but local prices are higher than those obtaining in England, to say nothing of foreign quotations. Scottish prices are weakening, however, and may soon be competitive. Pig iron, likewise, is a dull market. Continental offers of basic iron still show a substantial difference in price, in comparison with local charges, and some consumers therefore have been inclined to favour the former wherever suitable. Local producers, however, are hopeful of an early improvement when a more settled state of affairs is apparent. Scrap material has few buyers at present.

Coal.

The coal trade has hardly yet recovered from the effect of the railway strike, the result of which is still apparent at the loading stations. A scarcity of empty wagons at the collieries is delaying shipments, and the work of getting away the steamers delayed during the strike is greatly hampered. For the same reason, the collieries have little fuel to offer, and even although foreign demands are scarce, quotations are fully maintained for either short or long delivery. Aggregate shipments amounted to 228,396 tons, against 187,394 tons in the preceding week and 298,145 tons in the same week last year. The home market is fairly active, and supplies are adequate to the needs of most consumers. Prices are now almost as they were prior to the railway strike.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

Coal Trade Outlook.

THE coal trade remains very firm, but unfortunately it is extremely difficult to gauge with any certainty the future. Hopes are entertained that the threatened dockers' strike will not mature on the 16th inst., but the doubt that it may not be the case is prejudicing operations, for the reason that shipowners are hesitating to fix their steamers ahead for loading here, and prefer to look for business elsewhere. Furthermore, there is the fear of trouble later with the miners, more especially as whatever happens nationally, the feeling prevails that the miners in South Wales may adopt independent action and force a stoppage in support of their demands respecting wages. The next three months is generally regarded as a very trying period for business men, as it is quite possible that the demands for coal will be active, while at the same time rates of freight are likely to improve. Usually, if coals advance, then some relief is expected in the rates of freight, and *vice versâ*; but there is a distinct danger that both coals and freights may harden, which makes the risks of taking future c.i.f. business very difficult. Homeward markets have lately improved, especially from the Plate, and the consequence is that shipowners are sending their tonnage far afield. It is a long time since tonnage was so distributed over the globe, and this means that tonnage available for loading from this country will be rather scarcer during the next few months. During the past week there has come over the outward market quite a different complexion, inasmuch as rates of freight for the Mediterranean have advanced quite a shilling per ton, and the upward tendency of the market is still strong. This is making exporters reflect—if, indeed, it does not make them regret having taken certain business ahead—while so far as entertaining other orders is concerned, they are naturally becoming very cautious. Tenders went in this week for the Egyptian State Railways' inquiry for 200,000 tons of large steam coals for delivery from March over a period of five months, and the result is eagerly awaited, for the reason that the trend of the freight market alone this week has doubtless made many exporters revise their ideas as to what they are likely to get tonnage at to lift the coals, if part of the order is placed with them.

Dockers' Threatened Strike.

South Wales will suffer very considerably if the threatened strike of dockers should take place. Discharging operations would at once cease, and this would mean that steamers which may be in dock or due with cargoes of iron ore, pitwood, &c., would have to wait, as no work would be done on them, and they would not become ready for their outward cargoes of coal. Furthermore, the coal trimmers at Newport, Swansea and Port Talbot are members of the Dockers' Union, and would presumably suspend operations, while the probability is that although the coal trimmers at Cardiff, Penarth and Barry have their own union they would adopt sympathetic action. The chances are that other workmen on the docks, some of whom are members of the National Union of Railwaymen, would be involved, so that it can be seen that the prospects of much, if any, work being done soon after the declaration of a strike would be disastrous for South Wales. For this reason it is hoped that something will be done by the interested parties to overcome the difficult position.

Anthracite Coal Developments.

Several well-known undertakings are developing their mineral holdings in the anthracite area of this district, and the latest report to this effect is that a colliery is to be opened near the northern outcrop of the anthracite coalfield at Cwmllynfell on the borders of Glamorgan and Carmarthenshire. A company was formed last year to secure a mineral property, known as Tygwyn, and it is now reported that coal has been found and that the well-known Trigloin seam has been proved. The quality of the coal is described as first-class and specially suitable for malting purposes and also for the French market. It is proposed to lay down railway sidings as quickly as possible and erect up-to-date breaking, screening and washing plant, capable of dealing with an output of several hundred tons daily. The seam proved is 2ft. 9in. in thickness. The reserves of coal on this property are estimated at several millions of tons. This new property is close to that of the well-known Gwaun-cae-Gurwen Colliery Company.

Rhondda Miners and New Agreement.

The miners in the Rhondda district No. 1 have expressed their dissatisfaction with the attitude of the Miners' Federation of Great Britain executive towards a new wages agreement. According to Mr. A. J. Cook, the executive were not prepared to consider the recent ballot as an instruction to draft a new agreement, and although notices to terminate the agreement would come into effect on April 17th, the executive had decided to negotiate on the old proposals. The Rhondda miners passed unanimously a resolution that the district's representatives should urge the South Wales Federation executive to call an immediate conference to discuss the whole situation, and to decide upon proposals to forward to the Miners' Federation of Great Britain.

Current Business.

There has been a fair amount of business done in steam coals for prompt loading. The market on the whole is very firm, as collieries are so fully booked, and have got into arrears, owing to the recent strike on the railways. The docks are very congested with tonnage in berth and waiting for cargoes, and the loading pressure all round is very heavy. Here and there a certain amount of weakness prevails on account of the fact that while collieries may have the tonnage in dock, their steamers are not in berth, and consequently the coal cannot be tipped, and meanwhile the collieries are getting short of empty wagons. As regards forward business, coalowners are very optimistic, and in view of this they decline to sell ahead unless they can get prices in advance of those ruling. Business has been done at 31s. 6d. for the best Admiralty large, and second qualities are on the basis of 29s. to 29s. 6d. Small coals are also extremely scarce, especially coking sorts, for which 24s. to 25s. is indicated. Pitwood is very much firmer at 32s. to 33s., this being due to the strike at Bordeaux.

Latest News from the Provinces.

THE MIDLANDS AND STAFFORDSHIRE.

Suggested Bolt and Nut Combine and Prices.

WIDE interest continues in the Midland bolt and nut trade concerning the movement which is afoot for getting all the English and Scotch makers in the black bolt and nut trade to enter into a combine with a view to arresting the ruinous internal competition in selling prices which has been going on now for some time past. An important meeting has this week been held in Manchester with the object of carrying the scheme further forward. So severe is the competition which has been going on that some Black Country firms have been undersold on railway contracts and some similar heavy work by as much as £4 per ton. South Wales works ownership has accounted for some of the most serious "cutting," and important Indian State contracts have been prominent in the business that has suffered. Last November an advance of £1 per ton was declared in prices, and if the present scheme could be carried through, a further advance of £1 or £2 per ton would certainly be accomplished. At present the trouble is the large number of firms engaged in the industry, numbering as they do nearly fifty, taking the kingdom as a whole. Among the most ambitious of the districts favouring an all-British combine is the Scotch trade. For several years past the Scotch makers have all operated as one concern. Whether, however, the Scotch advocacy will be sufficient to overcome the difficulties in the opposite direction, arising especially from competition from the Principality, is, I fear, very doubtful. This week's meeting in Lancashire has not, I fancy it will be found, been successful in drawing the trade much nearer together. The future, however, is full of possibilities and equally full of interest.

LAUNCHES AND TRIAL TRIPS.

CITY OF LANCASTER, steel screw cargo steamer; built by Palmer's Shipbuilding and Iron Company, Limited; to the order of Ellerman Lines, Limited; dimensions, 344ft., 45ft. by 26ft. 8in.; 5000 tons deadweight. Engines, triple-expansion; constructed by the builders; launch, January 22nd.

NORMAN P. CLEMENT, steamer; built by J. Samuel White and Co., Limited; to the order of the Eastern Steamship Company, Limited, of Canada; dimensions, 258ft. by 43ft. 1in. by 20ft.; 2400 tons deadweight. Engines, triple-expansion, 16in., 27in., 47in. by 30in. stroke; pressure, 180 lb.; constructed by the builders; launch, January 22nd.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

THE NATIONAL GAS ENGINE COMPANY, Limited, of Ashton-under-Lyne, informs us that Mr. T. C. Wild, of Sheffield, has rejoined its staff as outside salesman for National engines.

MR. CHARLES E. DOUGLAS, M.I. Mech. E., informs us that he has resigned from the board of Douglas and Grant, Limited, of Kirkcaldy, and that he is now engaged in business on his own account at 34, Great James-street, Bedford-row, London, W.C. 1. Telegraphic address, Cedricemil, Holb., London, and telephone number, Museum 447.

WE are asked to state that Messrs. Guy F. Dowding and Co., of *Morning Post* Building, Strand, W.C., have been appointed sole agents for Great Britain and the Dominions for:—The Montbard-Aulnoye Tube Works, Paris, and for Les Etablissements Arbel (Wagon Works), Paris, with works at Douai and Couzon.

RICHARD GARRETT AND SONS, Limited, of Leiston, ask us to announce that on and after February 9th, their sales department will be situated in their London offices—Aldwych House, Aldwych, W.C. 2—and that all matters relating to the purchase of new machinery will be dealt with from that address. This change of address will involve no alteration in the *personnel* of the company's staff.

CRAVEN BROTHERS' TIRE BORING MACHINE.—We have been requested by Messrs. Craven Brothers (Manchester), Limited, to state that the tire boring machine which was described in THE ENGINEER last week forms the subject of letters patent.

THE INSTITUTE OF METALS.—The annual general meeting of the Institute of Metals will be held at the Institution of Mechanical Engineers, Storey's-gate, Westminster, on Wednesday and Thursday, March 12th and 13th, commencing each day at 10.30 a.m. The Presidential address will be delivered by Professor T. Turner, M.Sc., A.R.S., in the morning of March 12th. The annual dinner of the Institute will be held at the Trocadero Restaurant on Wednesday, March 12th.

THE *Hardware Trade Journal*.—Martineau and Smith's "Monthly Circular" came into existence in January, 1874, and was subsequently converted into the *Hardware Trade Journal*, which therefore celebrated its jubilee last week with an extra number, of which the greater part is devoted to a series of articles, entitled "Fifty Years of Progress." Amongst these articles will be found a very interesting review of the life of the *Journal*, whilst another notable feature of the number is an extensive portrait gallery of hardware trade principals who have been in business for fifty years. Altogether, it is a number on which the editor and the proprietors—Messrs. Benn Brothers—are to be no less congratulated than on the attainment by the *Journal* of its fiftieth birthday.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. COAST—	
Native	19/6 to 26/-
(1) Spanish	23/-
(1) N. African	23/-
N.E. COAST—	
Native	—
Foreign (c.i.f.)	24/-

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
(2) SCOTLAND—		
Hematite	5 8 9	—
No. 1 Foundry	5 10 0	—
No. 3 Foundry	5 0 0	—
N.E. COAST—		
Hematite Mixed Nos.	5 1 6	5 1 6
No. 1	5 2 6	5 2 6
Cleveland—		
No. 1	5 0 0	5 0 0
Silicious Iron	5 0 0	5 0 0
No. 3 G.M.B.	4 18 0	4 18 0
No. 4 Foundry	4 16 0	4 16 0
No. 4 Forge	4 15 0	4 15 0
Mottled	—	—
White	—	—
MIDLANDS—		
(3) Staffs.—		
All-mine (Cold Blast)	9 2 6	—
North Staffs. Forge	4 10 0 to 4 12 0	
„ „ Foundry	4 17 6	—
(3) Northampton—		
Foundry No. 3	4 13 6 to 4 15 0	
„ Forge	4 7 6	—
(3) Derbyshire—		
No. 3 Foundry	4 15 0 to 4 17 6	
Forge	4 8 0 to 4 10 0	
(3) Lincolnshire—		
No. 3 Foundry	4 15 6	—
No. 4 Forge	4 14 0	—
Basic	4 15 0	—
(4) N.W. COAST—		
N. Lancs. and Cum.—		
Hematite Mixed Nos.	5 15 0 (a) / 6 0 0 (b)	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
SCOTLAND—		
Crown Bars	12 10 0	—
Best „	—	—
N.E. COAST—		
Crown Bars	12 0 0	—
Tees	10 0 0	—
LANCS.—		
Crown Bars	12 10 0	—
Second Quality Bars	11 15 0	—
Hoops	15 0 0	14 15 0
S. YORKS.—		
Crown Bars	12 10 0	—
Best „	13 10 0	—
Hoops	14 10 0	—
MIDLANDS—		
Crown Bars	12 10 0 to 12 15 0	
Marked Bars (Staffs.)	14 10 0	—
Nut and Bolt Bars	11 10 0	—
Gas Tube Strip	12 17 6	—

STEEL.

	(6) Home. £ s. d.	(7) Export. £ s. d.
(5) SCOTLAND—		
Boiler Plates	13 10 0	—
Ship Plates, ¾in. and up	10 5 0	—
Sections	10 0 0	—
Steel Sheets, 3/16in. to ¾in.	12 10 0	—
Sheets (Gal. Cor. 24 B.G.)	—	19 0 0

STEEL (*continued*).

	Home. £ s. d.	Export. £ s. d.
N.E. COAST—		
Ship Plates	10 5 0	—
Angles	10 0 0	—
Boiler Plates	13 10 0	—
Joists	10 0 0	—
Heavy Rails	9 0 0	—
Fish-plates	13 0 0	—
Channels	9 5 0	—
Hard Billets	10 5 0	—
Soft Billets	9 0 0	—
N.W. COAST—		
BARROW—		
Heavy Rails	9 5 0†	—
Light „	9 10 0 to 10 0 0†	
Billets	9 10 0 to 12 0 0†	
Hoops	14 10 0	—
MANCHESTER—		
Bars (Round)	10 10 0 to 10 15 0	
„ (others)	10 5 0 to 10 7 6	
Hoops (Best)	15 5 0	15 0 0
„ (Soft Steel)	13 15 0	13 10 0
Plates	10 10 0	—
„ (Lancs. Boiler)	13 10 0	—
SHEFFIELD—		
Siemens Acid Billets	12 10 0	—
Bessemer Billets	13 0 0	—
Hard Basic	10 5 0	—
Intermediate Basic	10 0 0	—
Soft Basic	9 15 0	—
Hoops	12 10 0 to 13 0 0	
Soft Wire Rods	11 10 0	—
MIDLANDS—		
Small Rolled Bars	10 15 0 to 11 0 0	
Billets and Sheet-bars	8 0 0 to 8 5 0	
Gas Tube Strip	10 15 0 to 11 0 0	
Sheets (20 W.G.)	11 10 0 to 12 0 0	
Galv. Sheets, f.o.b. L'pool	18 5 0 to 18 10 0	
Angles	10 0 0	—
Joists	10 0 0	—
Tees	11 0 0	—
Bridge and Tank Plates	10 10 0	—

NON-FERROUS METALS.

SWANSEA—	
Tin-plates, I.C., 20 by 14	23/9 to 24/3
Block Tin (cash)	257 5 0
„ (three months)	256 5 0
Copper (cash)	60 15 0
„ (three months)	61 2 6
Spanish Lead (cash)	32 12 6
„ (three months)	31 17 6
Spelter (cash)	35 2 6
„ (three months)	34 6 3
MANCHESTER—	
Copper, Best Selected Ingots	66 5 0
„ Electrolytic	66 15 0
„ Strong Sheets	95 0 0
„ Tubes (Basis price)	0 1 1
Brass Tubes (Basis price)	0 1 0
„ Condenser	0 1 2½
Lead, English	34 5 0
„ Foreign	32 12 6

FERRO ALLOYS.

(All prices now nominal.)

	Per Ton.	Per Unit.
Tungsten Metal Powder	1/9 per lb.	
Ferro Tungsten	1/5 per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£23 0 0	10/6
„ 6 p.c. to 8 p.c. „	£22 10 0	8/-
„ 8 p.c. to 10 p.c. „	£22 0 0	8/-
„ Specially Refined		
„ Max. 2 p.c. carbon	£45 0 0	18/-
„ „ 1 p.c. „	£56 0 0	21/-
„ „ 0.75 p.c. carbon	£68 0 0	22/6
„ carbon free	1/6 per lb.	
Metallic Chromium	4/- per lb.	
Ferro Manganese (per ton)	£17 for home, £17 for export	
„ Silicon, 45 p.c. to 50 p.c.	£11 5 0 scale 5/- per unit	
„ „ 75 p.c.	£18 10 0 scale 6/- per unit	
„ Vanadium	20/- per lb.	
„ Molybdenum	8/6 per lb.	
„ Titanium (carbon free)	1/3 per lb.	
Nickel (per ton)	£130	
Cobalt	11/- per lb.	
Aluminium (per ton)	£82 to £100 (British Official.)	

FUELS.

SCOTLAND.

	Export.
LANARKSHIRE—	
(f.o.b. Glasgow)—Steam	25/-
„ „ Ell	26/6
„ „ Splint	27/- to 28/-
„ „ Trebles	26/6
„ „ Doubles	24/6
„ „ Singles	22/-
AYRSHIRE—	
(f.o.b. Ports)—Steam	25/-
„ „ Splint	26/6
„ „ Trebles	26/6
FIFESHIRE—	
(f.o.b. Methil or Burntisland)—Steam	22/6 to 24/9
Screened Navigation	29/-
Trebles	27/6
Doubles	24/9
Singles	22/6
LOTHIANS—	
(f.o.b. Leith)—Best Steam	24/9
Secondary Steam	23/3
Trebles	26/9
Doubles	24/9
Singles	22/3

ENGLAND.

	Export.
(8) N.W. COAST—	
Steams	29/-
Household	48/- to 50/-
Coke	40/-
NORTHUMBERLAND—	
Best Steams	25/6
Second Steams	23/-
Steam Smalls	15/-
Unscreened	22/-
Household	25/- to 28/-
DURHAM—	
Best Gas	24/6 to 25/-
Second	23/- to 23/6
Household	26/- to 28/-
Foundry Coke	40/- to 42/-
SHEFFIELD—	Inland.
Best Hand-picked Branch	35/- to 36/- —
Barnsley Best Silkstone	30/6 to 32/- —
Derbyshire Best Brights	30/- to 32/- —
„ „ House	26/- to 27/- —
„ „ Large Nuts	24/6 to 25/6 —
„ „ Small „	18/6 to 20/6 —
Yorkshire Hards	25/- to 27/- —
Derbyshire „	24/- to 25/- —
Rough Slacks	12/6 to 13/6 —
Nutty „	10/- to 12/- —
Smalls	7/- to 9/- —
Blast-furnace Coke (Inland)	27/- to 29/-
„ „ (Export)	f.o.b. 35/- to 36/-

(9) SOUTH WALES.

CARDIFF—	
Steam Coals :	
Best Smokeless Large	30/6 to 31/6
Second „ „	29/- to 30/-
Best Dry Large	29/- to 30/-
Ordinary Dry Large	27/- to 28/-
Best Black Vein Large	29/- to 30/-
Western Valley „	28/- to 29/-
Best Eastern Valley Large	27/6 to 28/6
Ordinary „ „	26/- to 27/-
Best Steam Smalls	22/- to 23/-
Ordinary „	20/- to 22/-
Washed Nuts	28/- to 30/-
No. 3 Rhondda Large	30/- to 31/-
„ „ Smalls	25/- to 26/-
No. 2 „ Large	24/- to 25/-
„ „ Through	21/- to 23/-
„ „ Smalls	19/- to 20/-
Coke (export)	55/- to 60/-
Patent Fuel	30/- to 32/6
Pitwood (ex ship)	32/6 to 33/6
SWANSEA—	
Anthracite Coals :	
Best Big Vein Large	40/- to 42/6
Seconds	32/6 to 35/-
Red Vein	30/- to 31/-
Machine-made Cobbles	50/- to 52/6
Nuts	50/- to 55/-
Beans	45/- to 46/-
Peas	20/- to 27/-
Breaker Duff	12/9 to 13/-
Rubbly Culm	13/9 to 14/3
Steam Coals :	
Large	24/6 to 25/-
Seconds	22/- to 23/-
Smalls	14/- to 16/-
Cargo Through	19/- to 21/-

(1) Delivered. (2) Net Makers' works. (3) f.o.t. Makers' works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire and Ayrshire.

(6) Home Prices—All delivered Glasgow Station. Boiler Plates 10/- extra delivered England. (7) Export Prices—f.o.b. Glasgow.

(8) Except where otherwise indicated, coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b.

† Latest quotations available. (a) Delivered Sheffield or Glasgow. (b) Delivered Birmingham.

French Engineering Notes.

(From our Correspondent in Paris.)

Iron and Steel Production.

THE output of pig iron and steel during 1923 was far greater than could have been anticipated in view of the shortage of coke during the early period of the Rhur occupation. Instead of there being an adverse balance, the production largely exceeded the total for the previous year. The great drop during the five months after the seizure of the Ruhr was followed by a rapid recovery, when the huge purchases of coke from abroad allowed of the putting of an increasing number of furnaces in blast. Of the total number of 221 furnaces in existence, the number in blast on January 1st, 1923, was 116. This number dropped to as low as 77 in March, but there was thenceforward a steady progression, until the number in operation on January 1st last was 125. The total production of pig iron in 1923 was 5,299,586 tons, representing an increase of 170,978 tons on the previous year and of 92,581 tons on the latest pre-war total of 1913. The production of steel amounted to 4,976,869 tons, or 505,594 tons more than in 1922, and 289,869 tons in excess of the figure for 1913, the latter increase, alike in pig iron and steel, being due to the retrocession of Lorraine. Seeing that Lorraine itself, which was particularly affected by the restrictions of coke supplies from the Ruhr, produced 1,867,164 tons of pig iron and 1,576,659 tons of steel in 1923, it is evident that the remaining French production is still far from reaching its maximum. The increasing production, coupled with the higher costs, has created a state of things which will inevitably result in complications in the early future. Although efforts are being made to secure a harder quality of coke in the Saar and the north of France suitable for blast-furnaces, it is evident that the Lorraine consumers will have to rely upon the Rhur for the main source of supply, and if the production of pig iron is to increase largely, the increase can only be brought about for the time being by the importation of British coke, which, at the present rate of exchange, puts the price at an almost prohibitive level.

The Saar Production.

The province of Saar, which is temporarily attached to France under the Versailles Treaty, has probably a larger variety of metallurgical and engineering industries than any other part of the old German Empire. With an abundance of raw material and plenty of labour, it produces everything under particularly favourable conditions as regards cost, and so long as the Treaty provides for the free importation of Saar products into France and Germany, there is little difficulty in disposing of the output. Next year, however, Germany will be at liberty to impose duties on Saar goods, but France will be obliged to allow the free importation of products from a country which is regarded, for the time being, as French territory. Should therefore Germany impose duties on manufactured goods from the Saar, a situation will be created that may cause considerable trouble to French engineering firms, which are themselves finding it necessary to look abroad for orders, and an invasion of the market by Saar manufacturers would have disastrous consequences for the home industries. To avoid this dilemma, something must be done at once to ensure an outlet for Saar products in such a way that they will not enter into direct competition with similar French goods. If Germany should, for political and economical reasons, treat the Saar as a foreign country, there will be no markets in Europe, other than Switzerland and Italy, left open to that province, and if the Saar manufacturers find themselves placed on the same level as British and other firms in dealing with Germany, they will have no alternative but to sell in the country of their temporary adoption. This is what they are trying to do now by a system of organisation and publicity which is causing some alarm to French engineering firms, apart, of course, from those directly interested in Saar undertakings. The Government is hoping to avoid this trouble by an arrangement with Germany, whereby the existing state of things will be maintained and confirmed by a commercial treaty, but should Germany prove refractory, the only solution at present proposed is to provide special facilities for the transport of Saar products over the French railways and waterways to the ports of shipment, so that the Saar will become a competitor for foreign trade instead of dumping its goods into France. The Saar manufacturer, however, will require a good deal of inducement to forego the advantages of selling his products in this country.

Paris Water Supply.

The Paris Municipal Council finds itself in another serious difficulty through under-estimating the cost of carrying out the works for bringing an additional supply of water from the Voulzie. The original estimate of 54 million francs has already swollen to 81 millions, largely through a mistake in calculating the cost of the cast iron mains, which is nearly double the price originally fixed, and as the price is controlled by a trust of pipe manufacturers, the Municipal Council has no alternative but to pay. As funds are low, the work can only be completed by means of a loan, and it was intended to profit from this opportunity to raise new capital to carry out a programme involving an expenditure of 225 million francs for doubling the Paris mains and preparing for additional water supplies and of 200 millions for sewage disposal. At present the Paris mains are only capable of delivering about 1,400,000 cubic metres of water for a population of 2,800,000. Since the report in favour of a 400 million franc loan was approved of, the situation has been changed so completely by the financial proposals to improve the value of the franc, that it has become necessary in this, as in other ways, to reduce expenditure to an absolute minimum. After a long discussion, the Municipal Council has fixed the amount of the loan at 120 million francs, which is at least required to complete the works for bringing water from the Voulzie and the Durteint and for increasing the capacity of the Paris mains to deal with these additional supplies.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

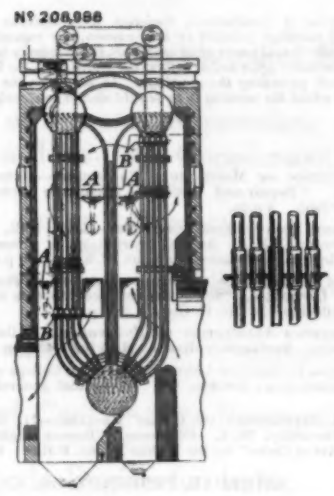
Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

STEAM GENERATORS.

208,988. June 7th, 1923.—WATER-TUBE BOILERS, *Babcock and Wilcox, Limited*, 30, *Farringdon-street, London, E.C.*

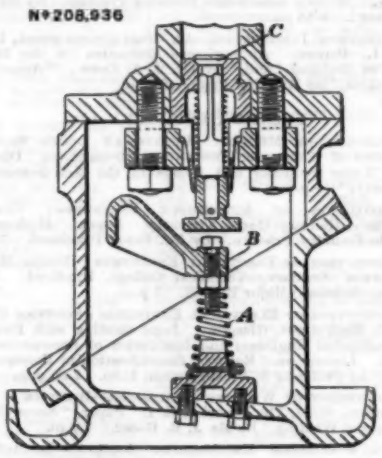
This invention relates to a water-tube boiler, especially designed for use where there are large quantities of dust in the gases, such as waste heat boilers, and consists in an arrangement by which the baffles and tubes may be relieved of the accumulation of dust which will collect thereon. The baffles A A are mounted on pivots, and can be cleared by rocking them manually, while the tubes are freed of dust by scrapers B B, much after the fashion of an economiser. An enlarged view of a set of scrapers is given.—*January 3rd*, 1924.



INTERNAL COMBUSTION ENGINES.

208,936. January 22nd, 1923.—GOVERNOR CONTROLLED FUEL PUMPS, C. Day, of Mirrlees, Bickerton and Day, Limited, Stockport, Cheshire.

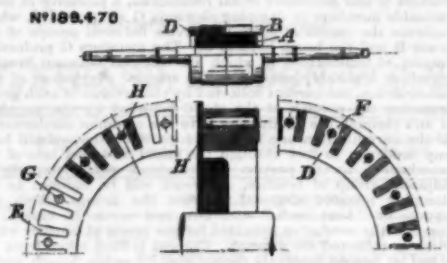
The inventor suggests that with the usual arrangement for governing oil engines by holding open the suction valve of the fuel pump, there is a liability for the engine to race, in the event of breakage of the governor gear, as the valve will be free to close. He thus arranges a spring A under the tappet B, which operates the suction valve C. If any of the governor gear breaks or becomes deranged, this spring holds the valve open, and, by preventing the supply of fuel to the engine, insures against any racing.—*January 3rd*, 1924.



DYNAMOS AND MOTORS.

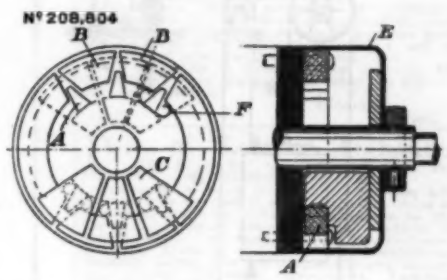
189,470. November 28th, 1922.—IMPROVEMENTS IN ROTOR WINDINGS FOR DYNAMO ELECTRIC MACHINES, Ateliers de Constructions Electriques de Charleroi, of 91, Rue de l'Enseignement, Brussels.

This invention relates to rotor windings and more particularly to squirrel cage windings as used in asynchronous motors. According to the specification, a short circuiting ring is slotted to receive key members adapted to force the ring into intimate contact with the rotor conductors. The plates A of the armature are mounted on a shaft, and through the plates the bars or conductors B pass. On the ends of the conductors the short-circuiting rings D are mounted. Notches E receive the bars or conductors. In order to cause the teeth F of the short-circuiting rings D to grip the bars or conductors B, and ensure a good contact between the rings D and the conductors, the teeth are perforated with holes G, into which pins H are driven. The pins are tapered at their entering edge, in order to facilitate their insertion. Their diameter is slightly larger than the diameter of the holes G, so as to ensure a thorough gripping of the conductors between the adjacent teeth F. In driving the pins into their holes the metal of the ring D yields, and is compressed against the conductors B, and thus a perfect electric joint is ensured.—*January 3rd*, 1924.



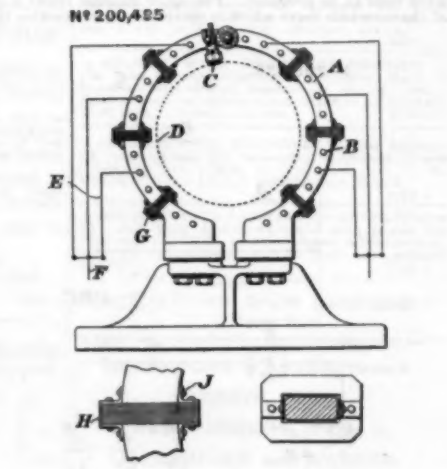
208,804. September 29th, 1922. IMPROVEMENTS IN AND RELATING TO SQUIRREL CAGE ELECTRIC MOTORS, Armais Arutünoff, of 22, Barbarossa-strasse, Berlin, W.

This invention relates to a squirrel cage armature in which the short circuit rings are subdivided for the purpose of increasing the resistance, that is to say, they are composed of separate annular pieces. The resistance is switched out automatically when the speed increases by spring contacts which gradually or simultaneously short circuit the bars by centrifugal contact action and so provide an armature with a low ohmic resistance. The contacts A are made of wedge shape and bear under the action of centrifugal force between two correspondingly wedge-shaped annular pieces B. In order to make the contact still more certain and reliable each contact member is provided with a weight C. The weight C must be guided so that it cannot diverge sideways. The whole arrangement is made dust-tight by means of a cap E. The wedge-shaped contact pieces A are retracted when the machine is stationary by springs F. The short circuit ring has a wedge-shaped groove turned in it into which the movable wedge-shaped contacts A enter under the action of centrifugal force.—*December 21st*, 1923.



200,495. June 18th, 1923.—IMPROVEMENTS IN OR RELATING TO ELECTRIC CURRENT COLLECTING BRUSH DEVICES, *Metropolitan-Vickers Electrical Company, Limited, of 4, Central-buildings, Westminster.*

This invention relates to current-collecting devices for alternating-current dynamo-electric machines, and it has particular relation to current equalising means for brush-holder stands. Heretofore, it has been observed that the current-collecting brushes of dynamo-electric machines, and particularly machines of the rotary converter type which employ a large number of brushes connected in parallel relation and co-operating with a single collector ring, are subjected to unequal wear. Extensive experiments have, therefore, been conducted with a view of determining the cause of the inequality in brush wear. As a result of the experiments, it has been ascertained that one of the principal causes of the unequal brush wear is the unequal flow of current through the various brush members which causes the decomposition of the brushes subject to excess current flow. According to this invention a current collecting device is provided with a plurality of conductors which are connected to the brush holder stand at equally spaced distances and are adapted to convey current to or away from a single brush or a group of adjacent brushes, damping means being associated with the brush holder stand and disposed between the brushes for preventing the flow of current through the stand from the portion which supports one of the brushes to a portion which supports another brush. A plurality of arcuate brush holder stands or "sickles" A are provided. Each of the stands is provided with a plurality of outwardly extending studs B upon which brush holders C are mounted for co-operation with a collector ring D. Conductors E connect the studs B in parallel to a common conductor F. The conductors E are, however, of greater resistance than the stands A by reason of their relatively smaller cross-sectional area. There is, therefore, a tendency for a greater part of the current to traverse

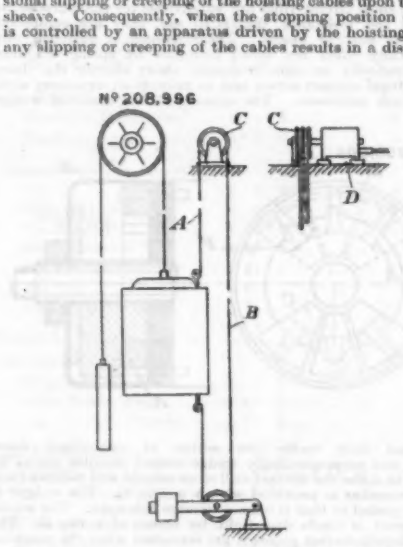


the stand to the lower-most conductor E and result in the disadvantage mentioned, rather than to divide equally between the conductors. In order, therefore, to avoid this tendency and to cause an equal amount of current to traverse the conductors E and encounter equal resistances, a plurality of magnetisable members or damping elements G are provided, which embrace the stands at spaced intervals between groups of the studs B and the brush holders C. The members G preferably consist of laminations H which are clamped between bracket members J suitably secured to the stands. By means of this construction, the current collected by the brushes of each group traverses the portion of the stand bounded by the members G and through the conductors E to the common conductor F. If the current from one of the groups of brushes should have any tendency to flow through the stand and past one of the members G to the portion of the stand which supports an adjacent group of brushes, a current will be induced in the damping member disposed between the groups which will oppose or "beat back" such flow and cause the current to traverse the conductor provided for the group of brushes which initially collected the current. Current is thus taken from the stand at spaced intervals throughout its entire length and is prevented from traversing the stand for any appreciable distance.—*January 3rd*, 1924.

CRANES AND CONVEYORS.

208,996. July 23rd, 1923.—LIFTS, *Waygood-Otis, Limited*, 54, *Fetter-lane, London, E.C.* 4.

In lifts employing the traction sheave system, there is occasional slipping or creeping of the hoisting cables upon the driving sheave. Consequently, when the stopping position of the car is controlled by an apparatus driven by the hoisting machine, any slipping or creeping of the cables results in a displacement

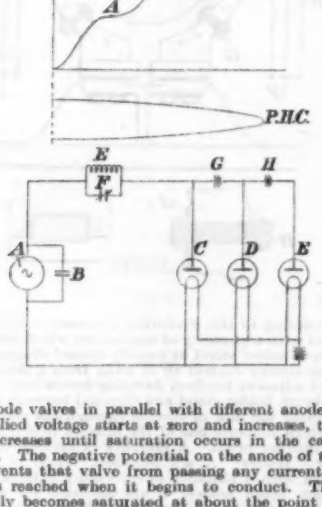


of the controller in relation to the actual position of the car, with the result that the accuracy of the landing is impaired. The floor controller, according to this invention, is consequently operated by two steel tapes, 0.01in. thick and 0.75in. wide. These tapes, A and B, are fixed to the cage and are wound in superimposed layers on drums C C on the shaft of the floor controller D. The inventors claim that with this arrangement the accuracy of landing is within $\frac{1}{16}$in.—*January 3rd*, 1924.

MISCELLANEOUS.

208,735. June 23rd, 1922.—IMPROVEMENTS IN AND RELATING TO ELECTRICAL APPARATUS PARTICULARLY FOR CHANGING THE FREQUENCY OR WAVE-FORM OF ALTERNATING CURRENTS, John Scott-Taggart and Radio Communication Company, Limited, both of 34/35, Norfolk-street, Strand, London, W.C. 2.

This invention relates to electrical apparatus and provides a means of producing varying electrical currents. It also provides a method of changing the frequency of alternating currents and enables an alternating-current of practically any wave form to be produced. The upper diagram shows a type of characteristic curve which is obtainable by connecting three



two-electrode valves in parallel with different anode voltages. If the applied voltage starts at zero and increases, the output current increases until saturation occurs in the case of the first valve. The negative potential on the anode of the second valve prevents that valve from passing any current until the point A is reached when it begins to conduct. The second valve finally becomes saturated at about the point B and at this point it is arranged that the third valve begins to conduct. This valve ultimately becomes saturated at the point C. The lower diagram shows a circuit for obtaining currents of multiplied frequency. The source of alternating current A is shunted by a condenser B which supplies alternating potentials to the anodes C, D, and E of the thermionic valves. In the main circuit there is an oscillatory circuit E F which may be tuned so as to be adjustable to the multiplied frequency obtainable by the device. The battery G gives the anode D a normal negative potential so that the second valve only begins to conduct some little time after the first one has become saturated. The battery H has its voltage added to G which makes the anode E still more negative so that the third valve E only begins to conduct some little time after the second valve has become saturated. It will be readily seen that if an alternating electro-motive force is applied to the compound conductor, the current flowing through E will rise and fall at intervals which may be made regular or irregular, although for frequency multiplication it is desirable that the intervals should be regular. The positive half cycle P.H.C. will cause three humps of maximum current through EF as the voltage is rising and three more humps as the voltage on the anode is falling. Six distinct humps could, therefore, occur in the output current, and these occurring at regular intervals would produce an oscillatory current in the circuit E F of a frequency six times that of the alternating source A.—*December 27th*, 1923.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

TO-DAY.

INSTITUTION OF MECHANICAL ENGINEERS.—Extra General Meeting. "Repair and Upkeep of Pneumatic Tools," by Mr. R. W. Wilson. 6 p.m.

BOROUGH POLYTECHNIC INSTITUTE.—Edric Hall, Borough-road, London, S.E. 1. Annual distribution of prizes and certificates by Mr. A. Chaston Chapman, F.R.S. 7.30 p.m.

JUNIOR INSTITUTION OF ENGINEERS.—39, Victoria-street, S.W. 1. Lecturette, "Some Physiological Aspects of Heating and Ventilation," by Mr. K. Gray. 7.30 p.m.

MANCHESTER ASSOCIATION OF ENGINEERS.—Midland Hotel, Manchester. Anniversary dinner. 6.15 for 6.45 p.m.

PHYSICAL SOCIETY OF LONDON.—Imperial College of Science, South Kensington, London, S.W. 7. Annual general meeting. 5 p.m.

ROYAL INSTITUTION OF GREAT BRITAIN.—21, Albemarle-street, Piccadilly, W. 1. Discourse, "Recent Lights on the Minoan Art of Crete," by Sir Arthur Evans, F.R.S. 9 p.m.

SATURDAY, FEBRUARY 9TH.

INSTITUTION OF AUTOMOBILE ENGINEERS. — Florence Restaurant, Rupert-street, London, W. 1. London graduates annual dinner. 7.15 p.m.

INSTITUTION OF ELECTRICAL ENGINEERS: SCOTTISH CENTRE. Grosvenor Restaurant, Gordon-street, Glasgow. Smoking concert. 7 p.m.

KEIGHLEY ASSOCIATION OF ENGINEERS.—Assembly Room, Cycling Club, Cavendish-street, Keighley. Paper, "Industrial Research," by Mr. W. Wilson. 6.30 p.m.

MONDAY, FEBRUARY 11TH.

INSTITUTE OF METALS: SCOTTISH LOCAL SECTION.—Institution of Engineers and Shipbuilders in Scotland, 39, Elmbank-crescent, Glasgow. Paper, "The Properties of some Non-ferrous Alloys," by Mr. Robert Hay. 7.30 p.m.

INSTITUTION OF AUTOMOBILE ENGINEERS: BIRMINGHAM CENTRE.—Chamber of Commerce, New-street, Birmingham. Paper, Modern Automobile Foundry Practice," by Mr. Percy Pritchard. 6.45 p.m.

SURVEYORS' INSTITUTION.—12, Great George-street, London, S.W. 1. Papers, "Approximate Estimates for the Development of Building Land," by Mr. J. J. Done; "Approximate Estimates," by Mr. Alan Paull. 8 p.m.

TUESDAY, FEBRUARY 12TH.

INSTITUTE OF METALS: BIRMINGHAM LOCAL SECTION.—Chamber of Commerce, New-street, Birmingham. Discussion on "Waste Products and Losses in the Non-ferrous Metal Industry." 7 p.m.

INSTITUTION OF AUTOMOBILE ENGINEERS: COVENTRY CENTRE.—Railway Hotel, Coventry. Paper, "Modern Automobile Foundry Practice," by Mr. Percy Pritchard. 7 p.m.

INSTITUTION OF ELECTRICAL ENGINEERS: NORTH MIDLAND STUDENTS' SECTION.—Technical College, Bradford. Address by the chairman, Major H. Bell. 7 p.m.

INSTITUTION OF ELECTRICAL ENGINEERS: SCOTTISH CENTRE. —207, Bath-street, Glasgow. Joint meeting with Institution of Mechanical Engineers and Institution of Locomotive Engineers. Lecture on "Railway Electrification in Foreign Countries," by Professor S. Parker Smith, D.Sc. 7.30 p.m.

INSTITUTION OF WELDING ENGINEERS.—Institute of Marine Engineers, 85/88, The Minories, E. 1. Paper, "Some Chemical Aspects of Welding," by Mr. J. R. Booer. 7 p.m.

KING'S COLLEGE ENGINEERING SOCIETY.—Institution of Mechanical Engineers, Storey's Gate, S.W. 1. Anniversary meeting. "Economics as Applied to Mechanical Engineering," by Vice-Admiral Sir George Goodwin. 5.30 p.m.

MANCHESTER GEOLOGICAL AND MINING SOCIETY.—Queen's Chambers, 5, John Dalton-street, Manchester. Paper, "Aerial Ropeways." 4 p.m.

WEDNESDAY, FEBRUARY 13TH.

INSTITUTE OF METALS: NORTH-EAST COAST LOCAL SECTION. —Electrical Engineering Lecture Theatre, Armstrong College, Newcastle-on-Tyne. Paper, "Propeller Brass," by Mr. A. Logan. 7.30 p.m.

INSTITUTION OF AUTOMOBILE ENGINEERS.—King's Café, St. Peter's-street, Derby. Derby Graduates' meeting. Discussion on "Comparison of the Performances of Rolls-Royce 40–50 Horse-power and 20 Horse-power Cars." 7.30 p.m.

INSTITUTION OF CIVIL ENGINEERS.—Great George-street, S.W. 1. Informal meeting. Discussion on: "The Capacity to be Provided in Service-Reservoirs," to be opened by Mr. H. J. F. Gourley. 7 p.m.

INSTITUTION OF CIVIL ENGINEERS.—Students' visit to Stonebridge Park Power Station, London, Midland and Scottish Railway.

ASSOCIATION OF ENGINEERS-IN-CHARGE.—St. Bride Institute, Bride-lane, Fleet-street, London, E.C. 4. Paper, "Electrical Breakdowns and Methods of Prevention," by Mr. E. Mudd. 7.30 p.m.

RADIO SOCIETY OF GREAT BRITAIN.—Institution of Electrical Engineers, Savoy-place, Victoria Embankment, London, W.C. 2. Discussion, "Fine Wire Coils as an Aid to Distortionless Reception," opened by Mr. J. H. Reeves. 6 p.m.

THURSDAY, FEBRUARY 14TH.

INSTITUTE OF METALS: LONDON LOCAL SECTION.—85–88 The Minories, Tower-hill, London, E. 1. Paper, "Metals for Lamp Manufacture," by Mr. W. B. Clarke. 8 p.m.

INSTITUTION OF AUTOMOBILE ENGINEERS.—Works of Vauxhall Motors, Limited, Kimpton-road, Luton. Luton graduates' meeting. Paper, "Pleasure Car Rear Axles," by Mr. E. J. Smith. 7.30 p.m.

INSTITUTION OF CHEMICAL ENGINEERS.—Engineers' Club, Coventry-street, W. 1. Paper, "The Transport, Storage and Distribution of Hydrochloric Acid, with an Account of a Complete Modern Installation," by Mr. D. M. Newitt. 8 p.m.

OPTICAL SOCIETY.—Imperial College, South Kensington, London, S.W. 7. Annual general meeting. 7.30 p.m.

INSTITUTION OF ELECTRICAL ENGINEERS.—Savoy-place, Victoria Embankment, London, W.C. 2. Joint meeting with the Physical Society of London. Continuation of discussion on "Loud Speakers for Wireless and other Purposes." 6 p.m.

FRIDAY, FEBRUARY 15TH.

DIESEL ENGINE USERS' ASSOCIATION.—Engineers' Club, Coventry-street, W. 1. Discussion, "Heavy Oil Engine Working Costs," based on the second report of the Committee of the Association.

INSTITUTE OF METALS: SHEFFIELD LOCAL SECTION.—Albany Hotel, Forgate, Sheffield. Conjoint meeting with the Institution of British Foundrymen. 7.45 p.m.

INSTITUTE OF METALS: SWANSEA LOCAL SECTION.—University College, Singleton Park, Swansea. Paper, "Fatigue and the Elastic Limit," by Professor C. H. Desch, F.R.S. 7.15 p.m.

INSTITUTION OF PUBLIC LIGHTING ENGINEERS AND SUPERINTENDENTS.—Board Room of Holborn Borough Council, 197, High Holborn, W.C. 1. Inaugural meeting. 2 p.m.

JUNIOR INSTITUTION OF ENGINEERS.—39, Victoria-street, S.W. 1. Honorary members' lecture, "Some Suggestions for Road Transport Development," by Mr. D. S. Capper. 7.30 p.m.

OLD CENTRALIANS.—Engineers' Club, Coventry-street, W. 1. Twenty-first annual dinner. 7 for 7.30 p.m.

ROYAL INSTITUTION OF GREAT BRITAIN.—21, Albemarle-street, London, W. 1. Discourse on "The Origin of the Solar System," by Professor J. H. Jeans, F.R.S. 9 p.m.

WEST BROMWICH ENGINEERING SOCIETY.—Technical School, West Bromwich. Lecture, "The Evolution of Hand Tools," by Mr. A. S. Barnes. 7.30 p.m.

MONDAY, FEBRUARY 18TH.

INSTITUTION OF AUTOMOBILE ENGINEERS: SCOTTISH CENTRE. —Royal Technical College, Glasgow. Papers, "The Carburetter from the Hydraulic Point of View," by Mr. W. J. Duncan; "Small Diesel Engines," by Mr. James Richardson. 7.30 p.m.

TUESDAY, FEBRUARY 19TH.

INSTITUTE OF MARINE ENGINEERS.—85/88, The Minories, Tower Hill, E. 1. "Experiments on a Cylindrical Steam Boiler with and without Pre-heated Air," by Mr. D. H. Owen. 6.30 p.m.

INSTITUTION OF AUTOMOBILE ENGINEERS: WOLVERHAMPTON CENTRE.—Star and Garter Hotel, Wolverhampton. Paper, "Modern Automobile Foundry Practice," by Mr. H. C. M. Stevens. 7.30 p.m.

INSTITUTION OF ELECTRICAL ENGINEERS: NORTH MIDLAND STUDENTS' SECTION.—The University, Leeds. "Single-phase Induction Motors," by Mr. E. Barker. 7 p.m.

MANCHESTER METALLURGICAL SOCIETY.—College of Technology, Manchester. Paper, "The Inner Structure of Metals," by Messrs. F. C. Thompson and E. W. Millington. 7 p.m.

WEDNESDAY, FEBRUARY 20TH.

INSTITUTION OF AUTOMOBILE ENGINEERS.—Midland Hotel, Derby. Annual dinner of the Derby graduates. 7 p.m.

INSTITUTION OF AUTOMOBILE ENGINEERS.—Chamber of Commerce, New-street, Birmingham. Birmingham graduates' meeting. Paper, "Electric Starting and Lighting Equipment for Automobiles and Motor Cycles," by Captain H. C. Burgoine. 7.30 p.m.

THURSDAY, FEBRUARY 21ST.

INSTITUTION OF AUTOMOBILE ENGINEERS.—Watergate House, Adelphi, London, W.C. 2. London graduates' meeting. Paper, "The Possibilities of the Two-stroke Engine for Automobile Purposes," by Mr. L. F. Little. 7.30 p.m.

FRIDAY, FEBRUARY 22ND.

INSTITUTION OF AUTOMOBILE ENGINEERS.—Craven Arms Hotel, Coventry. Coventry graduates' annual dinner. 7.30 p.m.

INSTITUTION OF ELECTRICAL ENGINEERS: NORTH MIDLAND STUDENTS' SECTION.—Visit to the Penistone works of Cammell Laird and Co., Limited. Meet at Penistone Station at 2.50 p.m.

JUNIOR INSTITUTION OF ENGINEERS.—39, Victoria-street, London, S.W. 1. Lecturette, "Ciment Fondu: Its Manufacture and Special Uses," by Mr. J. S. Marshall. 7.30 p.m.

SATURDAY, FEBRUARY 23RD.

INSTITUTION OF AUTOMOBILE ENGINEERS.—Visit of the London graduates to the works of D. Napier and Son, Limited, Acton, W. 3. 2.30 p.m.

JUNIOR INSTITUTION OF ENGINEERS.—Visit to the British Empire Exhibition at Wembley to inspect the railway of Never-Stop Transit, Limited. 2 p.m.

TUESDAY, FEBRUARY 26TH.

INSTITUTION OF AUTOMOBILE ENGINEERS.—Royal Society of Arts, John-street, Adelphi, London, W.C. 2. Paper, "The Fundamentals of Cost Reduction," by Mr. H. Kerr Thomas. 6.30 p.m.

INSTITUTE OF MARINE ENGINEERS.—85/88, The Minories, Tower Hill, E. 1. "Electricity as the Motive Power for Ships," by Mr. L. Rothera. 6.30 p.m.

WEDNESDAY, FEBRUARY 27TH.

INSTITUTION OF CIVIL ENGINEERS: BIRMINGHAM AND DISTRICT ASSOCIATION.—Queen's Hotel, Birmingham. Annual dinner. 7 p.m.

WEDNESDAY, APRIL 9TH.

INSTITUTION OF NAVAL ARCHITECTS.—Connaught Rooms, Great Queen-street, London, W.C. Annual dinner. 7.30 p.m.

WEDNESDAY TO FRIDAY, APRIL 9TH TO 11TH.

INSTITUTION OF NAVAL ARCHITECTS.—Royal United Service Institution, Whitehall, London, W.C. 2. Annual general meetings.